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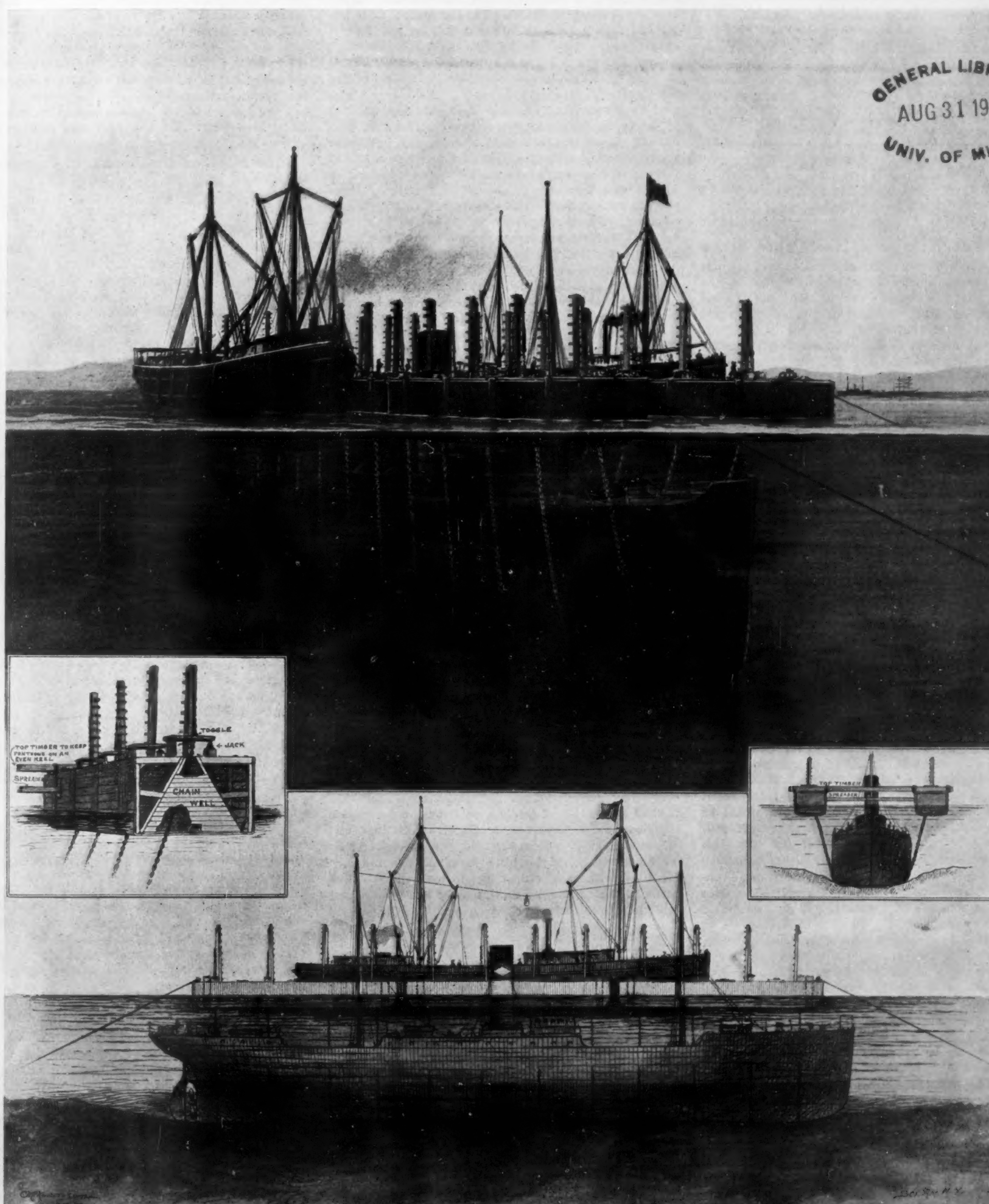

Method of raising a sunken vessel by passing chains under it and securing them to pontoons.

SALVING THE STEAMER "JOSE."—[See page 178.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Relative Sea Strength of the United States

ACCORDING to the latest estimate made by our admirable Office of Naval Intelligence of the Navy Department, the United States has already yielded the position of second in naval strength among the navies of the world to Germany. This is true, even if we take into consideration the battleships already built, and it is startlingly true, when we consider both the battleships built and those under construction. At the present time Great Britain possesses fourteen battleships of the dreadnought type, Germany eight, and the United States seven; Great Britain has eleven such ships under construction, Germany nine and the United States five only. In battleships of the pre-dreadnought type, such as the "Connecticut," "Georgia" and "Maine," Great Britain possesses forty-one, Germany twenty-one and the United States twenty-five, which gives us a superiority of five ships of this class over Germany. The pre-dreadnought battleships, however, because of their inferiority in speed and gun power will be at a great disadvantage when they come to lie in line of battle against the modern ten- and twelve-gun dreadnoughts. Even on a basis of the total tonnage of all ships completed, Germany still has a decided lead over the United States. Great Britain heads the list with 1,888,414 tons, followed by Germany with 787,799 tons, the United States with 758,499 tons, France with 619,512 tons, and Japan with 438,067 tons.

When we come to consider the vessels which are now under construction, the great activity of Germany and the comparative inactivity of this country produce a marked difference in the comparison. If all vessels now building were completed, Great Britain would lead with 2,469,678 tons, Germany would be second with 1,146,238 tons, and the United States would be third with 914,744 tons, France would come next with 804,211 tons, and Japan fifth with 617,083 tons. Of dreadnought battleships and battle cruisers combined, Great Britain would possess thirty-six, Germany, twenty-five, and the United States, twelve only—less than one half the strength of Germany, and just one third the dreadnought strength of Great Britain.

In the presence of these figures, it is simply bewildering to attempt to understand the attitude of the House of Representatives in its attempt to prohibit the construction of more battleships. In one single week Congress has seen fit to reaffirm the Monroe Doctrine and to repudiate the pledges of a treaty, the ink of whose signatories is scarcely yet dry. Statesmanship of this kind can scarcely be called pacific. If it is the policy of Congress to tear up treaties and cry "hands off" from the only promising field remaining for colonial exploitation, this policy should surely be backed up with those armed forces which are necessary to render it successful. We believe there never was a time when the United States so greatly needed a strong navy as she does at this critical stage of her progress toward her ultimate dominant position among the world powers.

America's Need for an Aerotechnical Institute

THE inventors and builders of air craft in this country feel keenly the want of experimental data to form a rational basis for their structural designs; the users and students of air craft experience an equal want of adequate and disinterested comparative tests of existing craft, appliances and accessories. There is, therefore, a general desire for an American aeronautical institute that shall meet these wants in the broadest and most thorough manner, an institute not for training aviators or instructing engineers, for this is already done in several places, but primarily for producing and disseminating aeronautical science.

In European countries some excellent laboratories for aeronautical research are privately endowed and conducted in the interest of civil science and construction; others having governmental support are intended primarily to subserve a military purpose and may not be readily available, if at all, for civilian use. The latter kind are, at present, not strongly demanded in this country, either by the army or the navy. Hence, if a federal appropriation for the advancement of aeronautical science be made at all, it should be alloted to one of the civil establishments, such as the Bureau of Standards, or the Smithsonian Institution. The latter can receive both private endowments and federal grants, has sufficient building space, an aeronautical library and the old Langley workshops, not to mention the Hodgkins fund of $100,000 for studies of the atmosphere.

If an aeronautical institute were privately founded it should have an endowment equal at least in purchasing power to the best in Europe, say twenty to thirty thousand dollars a year; its directorate should include representative men alert to the needs of aero science and industry; it should be practically independent in its finances and government, or if affiliated with a great seat of learning, should not be dominated by the president or teaching corps, or in any sense made a dependent of, or mere adjunct to, some scientific department.

Whether established by private means or governmental, or both, what our people require is a representative American institution "in which a staff of trained specialists, provided with adequate apparatus, shall furnish physical constants, laws, formulæ, and empirical data of substantial and permanent value to the engineer, the inventor, the manufacturer, whose energies should remain free to employ such knowledge to the advancement of important industrial arts; a laboratory where complete and reliable tests and reports shall be made upon all classes of actual air craft that may be worthy of study and development; an institution surrounded by ample maneuvering space of land and water, and preferably adjacent to a governmental flying ground, available with hangars and shops, to all civilians worthy of assistance; a center of scientific and practical activity, where at all times may be witnessed the most accurate researches and most exhaustive tests; where the knowledge so gained shall be disseminated by publications, by oral communications, by exhibitions of apparatus and instruments, of materials and models, by photographs and drawings, in a word, by all the facilities of the aerodrome, the show room, the library, and the assembly room."

The foundation of a national institute so comprehensive and thoroughgoing would greatly promote a direct and universal mode of locomotion, and would constitute a monument fit to bear the name of the most munificent patron of science. But unless an individual will endow such an institution adequately to meet all requirements for many years, it will be better for the votaries of aeronautics to initiate an establishment comprising such buildings and endowment fund that it shall be capable of ample growth by the cumulative contributions of many individuals or associations, and by occasional grants from the federal government. Better no aerotechnical institute than one too meagerly furnished with men or resources to meet the practical needs of the community and to make substantial contributions to the science in which America once enjoyed leadership.

Hon. W. G. Sharp, in an able appeal to the House of Representatives for the encouragement of aviation, recommended an appropriation for an aeronautical laboratory, and the Aero Club of America has, with the indorsement of prominent scientific bodies, pledged itself to secure the endowment of such an establishment. The SCIENTIFIC AMERICAN commends the movement most heartily.

The Possibility of the Oil Engine

THE internal combustion gasoline engine is being developed as much in the United States as elsewhere, and the Junkers oil engine, the most recent challenge of the reciprocating heat motor, may be expected to have a great career on this side of the Atlantic. Occasional oil engines in electric central station service—Diesel engines—are already reported, and any class of engine room attendant can operate them successfully.

For marine propulsion also, who knows but the staunch ships that will some day be launched to revive the ancient glory of the American merchant marine will be equipped with oil engines. Our own fuels and those of Europe and Asia will supply the tanks of these vessels, with the great oil fields of other parts of the globe to fall back upon, including the vast supply in Borneo. Oil is the coming fuel for propelling vessels. It is cheap, it saves space and weight, it requires a smaller crew, and it is incomparably preferable to coal in point of cleanliness. Roughly speaking, in the oil engine one ton of oil equals 3½ tons of coal, the economy being higher as the size of the engine is increased. In order to compete with oil, coal must be obtainable at thirty-nine cents per ton. As a power auxiliary for sailing craft the new engine should find a great field where steam has not had a very extensive application owing to the inconvenience of rigging a temporary funnel, the long time required to get up steam in an emergency, and the valuable cargo space taken up by the coal bunkers and the boiler. The oil engine, on the other hand, is always ready for instant use, no funnel is required, the space taken from the cargo capacity is but a small part of the whole, and the oil fuel can be stowed where it would be impracticable to carry coal. While these advantages are shared by the gasoline auxiliary, the new oil engine leads in the far lower cost of its fuel, in the extreme simplicity of the engine, seldom necessitating repairs or overhauling, the absence of any ignition mechanism, differential or reverse gear, and the excellent cooling system.

The Needs of the Bureau of Chemistry

WHAT shall be said of the powerful division chiefs in the Bureau of Chemistry, who, charged with safeguarding the health of ninety million people, fail to gather scientific evidence of a character that would enable the courts to bring dishonest food manufacturers, criminal dispensers of injurious beverages, and adulterers of healing drugs to book? And what shall be said of a government that permits a Bigelow, a Kebler and a Doolittle to squander public money in worthless analyses and to bring actions that any open-minded lawyer must know are futile? Only the press can rouse the public to a sense of the grave risks incurred by the maladministration of the Pure Food and Drugs Act for which these three men are largely responsible; but the public press knows nothing of science and publishes nothing but praise of the inept officials who control the Bureau of Chemistry.

The organization of the Bureau is in part responsible for a situation which has made scientific work almost impossible. At present those who are charged with the investigation of food and drug products are subject to the authority of Bigelow and Kebler, officials, in a word, in whose hands mainly lies the fate of the Food and Drugs Act. What could be more admirable? Is not this the practice of every manufacturing establishment? It so happens, however, that the Bureau is not a department store, where such a system might operate well, but a scientific institution, intrusted with highly important investigations that concern every man, woman and child of the ninety million people who constitute the population of this country. And it so happens that the division chiefs or their agents prosecute manufacturers for violations of the Pure Food and Drugs Act, not as scientific men, absolutely sure of their facts, but as district attorneys. Like district attorneys, they care only for the game of prosecuting, and measure their efficiency rather by the number of actions brought than by the character of their scientific work.

Under the present system the subjects for investigation are assigned to subordinate officials by the very division chiefs who are eventually to prosecute manufacturers guilty of fraud. The success of the division chiefs in court depends on the scientific findings of those who are assigned to the cases. If the division chiefs were men of any scientific standing, men who cared only for the scientific facts, the system might still be effective. But, caring chiefly for prosecutions and little for scientific truth, it can be imagined how little they care for research. The public is vitally interested in the proper enforcement of the Pure Food and Drugs Act, and consequently in the scientific investigations of the Bureau of Chemistry.

Waste in Paper-making.—Chemists attribute the great rise in the price of all sorts of paper in recent years largely to wasteful methods of manufacture, which for the most part the mills care little or nothing about checking. One well-known chemist said the other day: "Some years ago I made a contract, after much trouble, with a large paper mill. The first thing I did when I went to work was to collect samples of all their waste waters and determine the amount, proportion and kind of material that was going into the stream. This mill had never paid, though it was well located. One reason for their failure to pay a dividend, I found, was that 17 per cent of the product was floating off down the river. I told the manager about it. Well, he paid my salary for a year and never allowed me to come into the mill again."

Electricity

German Regulation of Wireless Telegraphy at Sea.—The new official regulations, requiring all German passenger steamers carrying a minimum of 75 persons, including the crew, to be equipped with wireless telegraph apparatus of a transmitting radius of 100 nautical miles, will go into effect on October 1st.

Heating Churches by Electricity.—Owing to the large amount of water-power in Switzerland, electricity can be applied to a good advantage and a low cost, for heating buildings, and it is stated that it is also being used in a number of instances for the heating of churches. Among these are the churches of Walfhalden, Schwellbrunn, Arosa, Sils, Brugg, Aengst and others.

Sweden's Hydro-electric Development in 1911.—The newly-erected hydraulic plants in Sweden for the last year amount to nearly 40,000 horse-power, and to this is to be added the extension made in the former plants during the year, which makes a total increase of 67,667 horse-power as against 62,385 for the preceding year. These figures relate to electric power plants installed by private companies. The height of the fall which is used here varies up to 240 feet, and in general it is under 80 feet.

A Large Electric Plant in Brazil.—A company has recently been formed for the purpose of constructing an electric power plant in Brazil which will be one of the largest in South America. The hydraulic station is to be located on the San Francisco River and the power will come from the Alphonso falls. It is stated in the French technical journals that the size of the plant during the initial period of operation will be about 200,000 horse-power, but at a later date the station may be extended so as to produce as much as 1,300,000 horse-power.

Pekin's Telephone System.—The telephone service of Pekin has been commenced by the installing of two central exchanges which are laid out for a total of 6,400 subscribers. There are about 3,000 subscribers in the Chinese and the Tartar quarters, and the remaining quarters are to be wired up at a no very distant period. It is to be noted that the two exchanges are constructed by the government and are now being operated by it. The legations already had many private telephones, and these are now connected to the above exchanges.

Wireless Telegraphy From Balloons.—A German experimenter, H. Mosler, has devised a method of using wireless telegraphy upon spherical balloons. He places a wire around the balloon body so as to form a vertical loop, also a second wire hanging down from the basket. More recently he has found it best to attach the loop wire to a band of stout canvas and then to lay this around the balloon bag so as to attach the band to the network and avoid putting the wire directly upon it as this might cut into the balloon. It is much better to have the loop lying to one side and not directly over the center, so that the wires coming together into the basket are away from the gas valve and are less likely to cause a fire.

Electric Steel Production in Norway and Sweden.—In Norway and Sweden there is considerable activity at present in the way of electric steel production. There are two new steel works with electric furnaces shortly to be erected which propose to turn out 16,000 tons annually during the first period, and this will no doubt be increased later on. One of these enterprises is carried on by the Stavanger Steel Company, which is capitalized at $1,200,000, and it is now arranging to secure 2,500 horse-power in electric current from a local hydraulic plant. The new works will include an electric furnace of the most recent design for steel production, with a rolling mill, steam hammers and foundry for steel casting. It is expected to turn out annually 1,600 tons of rolled steel, 300 tons forged steel, 600 tons cast steel, and 700 tons diverse. The second enterprise consists of an electric steel plant near Arendal and it will use current from the Boilejos hydraulic plant.

The Electric Furnace and Ferro-silicon.—The electric furnace process can be used to a great advantage in obtaining compounds of iron and silicon or ferro-silicon, and it is even possible to produce pure silicon in this way. The usual blast furnace methods are said to give a maximum of only 20 per cent silicon in the compounds obtained, but much more is given by the electric process. Besides, the impurities such as calcium, manganese, carbon and others are much less than before. It is noticed that ferro-silicon containing less than 30 per cent or more than 65 per cent is stable, but products lying between 30 and 65 per cent are easily decomposed. From a chemical standpoint it is admitted that there are at least three different silicides of iron, and perhaps two others. The present process is now being operated in Europe and is covered by patents, the electric furnace somewhat resembling a calcium carbide furnace, but it is found that a large-sized furnace is essential to obtain the proper results. Such must also be operated near to the center of raw material, with good transport facilities for the finished products.

Science

Drinking Cups For Horses.—The New York Bureau of Municipal Research announces that hereafter individual drinking cups and shower baths are to be used. The Bureau points out that among the 90,000 horses that perish every year in Manhattan no less than 6,500 succumb to glanders which is communicated by filthy horse troughs.

The Death of Schleyer.—On August 20th there died at Constance, Baden, Johann M. Schleyer. In 1879 he invented Volapuk, an artificial language that was as much spoken about in its day as Esperanto is now. His Volapuk was the first artificial language that attained any measure of practical success. When the third Volapuk Congress was held in 1889 two hundred and eighty three societies had been formed in various parts of the world to spread its use.

Prof. Frost Receives a Degree from Cambridge.—Prof. Edwin B. Frost, the director of the Yerkes Observatory, while a delegate to the 250th anniversary of the Royal Society was given the honorary degree of D.Sc. from Cambridge University. Prof. Frost will spend the year abroad in England and Germany. In his absence, Prof. S. Alfred Mitchell will be at Yerkes Observatory, having been granted a Sabbatical year for that purpose by Columbia University. Prof. Mitchell is well known to our readers from his contributions to the Scientific American on astronomical subjects.

Barring Insects.—On August 10th the House of Representatives passed a bill introduced last May by Representative James S. Simmons of Niagara Falls, N. Y., regulating the importation of plant products. Under this bill it will be unlawful for any person to import into the United States any nursery stock except under permit from the Secretary of Agriculture and under conditions and regulations prescribed by him. The United States is the only great power without protection from importation of insect-infested or diseased plant stock. Diseased livestock is excluded by law, but diseased plants, have as yet, not been barred.

The Origin of Novæ.—In the monthly notices of The Royal Astronomical Society for June, 1912, Prof. E. E. Barnard of Yerkes observatory has a paper on "Micrometrical Measures and Focal Peculiarities of Nova Lauertæ (Espin)." In the course of his paper, Prof. Barnard objects to the theory that the outburst of a nova is due to a star colliding with a nebula. He points out that photography does not show that the novæ are in nebulous regions except in the case of Nova Andromedæ and "even here the spectroscope throws doubt on the nebulosity." Prof. Barnard believes that we are probably dealing with real motion caused by some force not yet known. "Indeed," he assures us, "I think this, like some of the abnormal phenomena of the comets reveals to us the effects of new forces (call them that if you like) as yet unknown to us, but which we must take into consideration, as our knowledge of the universe advances."

A Catalogue of More Than 100,000 Stars.—At the Harvard College Observatory the most extensive astronomical labor ever undertaken is now in progress. Up to the present time, the largest and most complete star catalogue in existence has been the Draper Catalogue, which indexes about 10,000 stars, with careful details concerning their spectra. This catalogue was compiled by Mrs. Williamina Paton Fleming at Harvard before 1891. Since that year, the increasing size of telescopes and improvements in stellar photography have so greatly increased the number of stars shown upon the photographic plates that an entirely new edition of the Draper Catalogue, enlarged, and giving the record of each star to recent years seemed imperative. Prof. Edward C. Pickering, Director of the Harvard Observatory, has contemplated such an edition for many months, and in October, 1911, the work was begun. Since Mrs. Fleming's death in May, 1911, Miss Annie J. Cannon has been appointed Curator of the Astronomical Photographs, succeeding Mrs. Fleming, and Miss Cannon is in charge of the catalogue work. She is directing its progress so ably that what several distinguished astronomers feared they might not live to see accomplished, will probably be completed within five years. She has organized the research into divisions and sections, each of which is conducted by one or other of her women assistants. A vast collection of stellar photographs, giving a complete record of the heavens during many years, is available at Harvard through the co-operation of its Cambridge and Arequipa stations, so that abounding material is furnished for the catalogue. The work represents an infinite series of mathematical calculations, preliminary card-cataloguing, notations, charting, etc., which depends upon the utmost care in studying and comparing photographic plates, identifying stars, and determining their degrees of brightness, qualities and classes of spectrum. For such work women, says Prof. Pickering, have proved their especial adaptability. About 5,000 stars each month are indexed on the cards.

Aeronautics

Aerial Fleet for the Argentine Navy.—The Sociedad Sportina Argentina has made an offer to the Ministry of War, Gen. Gregorio Velez, of an aerial fleet, to be subscribed for by the public, for which purpose 1,500,000 illustrated post cards will be issued.

The Utility of Airships in the Treatment of Tuberculosis.—Dr. Flemming, a prominent medical authority, at a meeting of the Berlin Aeronautical Association, lectured on the beneficial effects of high altitudes on tuberculosis. He pointed out that 15 minutes' exposure to the sun's rays during an airship flight at high altitude meant certain death to the tuberculosis bacilli.

Recording Births in Aeroplane.—That the regulations and rules governing aerial travel will be modeled closely upon those in use on the sea is shown in the latest set proposed by the international committee. It provides among other things, that a death or birth occurring on an aeroplane or dirigible balloon in transit, must be reported by the pilot at the first landing place.

A French Hydro-aeroplane Contest.—The Automobile Club of France has organized a concourse of hydro-aeroplanes on the coast of Brittany and around the island of Jersey. This will be one of the most interesting events of the year in the way of sport and also from a technical standpoint. It has received the patronage of the Minister of the Marine who is to send a fleet of torpedo boats to accompany the flights as well as two battleships which will be stationed in the bay of St. Malo. The British Admirality is expected to co-operate in the movement. The Automobile Club awards $10,000 in prizes, and another prize is awarded by the island of Jersey for a race from St. Malo to the island and back.

The Michelin Cup.—This year the annual aeroplane race for the Michelin Cup representing a prize of $4,000 is to be a combined speed and touring event. On a given day the pilot is to cover three separate circuits laid out in the region of Paris, with the Buc grounds as a starting point. The first circuit is Buc, Rheims, Amiens, Rouen and return, and the total distance for the three circuits is 750 miles. Gasoline can only be taken on at the starting point, and the minimum speed is 36 miles an hour, but in fact it will take a speed of 75 miles an hour to succeed in the contest. This means an 11 hours' flight with the needed stops, so that the daylight period of 15 or 16 hours will be nearly approached. At all events the flights are likely to bring out some high speeds.

French Hydro-aeroplane Experiments.—During the recent maneuvers of the French fleet in the Mediterranean, the war vessel "Foudre" was fitted out so as to carry hydro-aeroplanes on board. This is easier to carry out than in the case of ordinary aeroplanes, as there is now no launching platform needed to start up the flyers. On the vessel, an overhead crane takes up the flyers as they leave the hangar and drops them overboard into the water. The first Nieuport monoplane of this kind piloted by Ensign Delage showed quite a success. It is of the 3-place type and carries a 100 horse-power Gnome motor. On one occasion the aeroplane was let overboard even during rough water, and it made a number of flights above the assembled fleet. One part of the fleet represented the enemy in the maneuvers and the aeroplane could observe its position and bring back a very correct report. Some of the flights with one passenger on board lasted for 3 hours at a time, flying above Toulon and the harbor and along the coast. Admiral Boué de Lapeyrère and his etat-major were much impressed with the performance of the hydro-aeroplanes on this occasion.

Aviators' Sickness.—Aside from the mountain sickness, due to the rarefaction of the air and the muscular work done by climbers, and also the balloon disease with analogous symptoms but which does not appear except at very high altitudes, we now have to take account of aeroplane or aviators' sickness, whose effects have already been spoken about. These are due to the rapidity with which the maximum height is reached and the still greater speed at the descent, that is, the passage from a low-air pressure to a higher one. M. Berget, a French aeronaut, after speaking of the conditions of the atmosphere in general, also brings out some points on this question. Aeroplanes sometimes reach altitudes of 10,000 feet in an hour, and here the effects on the ear such as humming or cracking noise are about the same as in a balloon, but the effect on the respiratory organs is different. The pilot is sooner out of breath and he feels a special kind of uneasiness. During the descent, the heart beats are of greater amplitude, but without accelerating. A quick descent in a sailing flight at a speed of 1,000 or 1,200 feet a minute or even more, since Morane descended at Havre from 8,000 feet height in 6 minutes, causes a feeling of a special kind, or uneasiness, accompanied with humming in the ears. Burning in the face is also felt and a severe headache, also the great tendency to sleep which has been before observed. The movements of the body are sluggish and unskilful. These symptoms continue for some time after the landing, and the tension in the arteries is noticed to be higher than the normal.

The Junkers Oil Engine

A New Type of Motor on the Diesel Principle

By Joseph B. Baker

PROF. H. JUNKERS, of Aachen, Germany, has developed a remarkable internal combustion engine utilizing the combustion (not explosion) of cheap, low-grade liquid fuels by the compression-ignition method of the Diesel engine, but with certain radical improvements in design which give increased efficiency and adaptation to all power purposes.

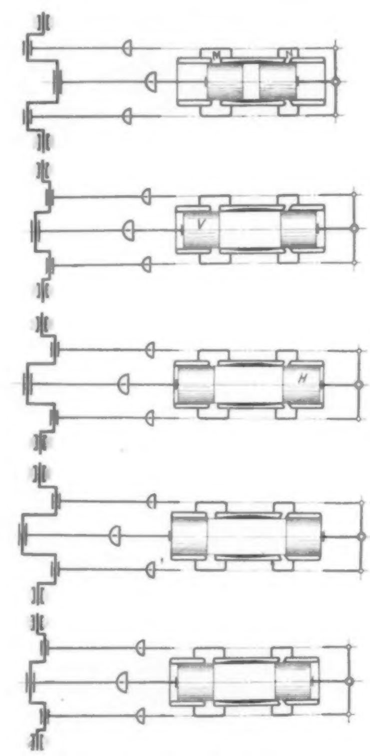
Just as Watt is the father of the steam engine in its manifold forms, so in our own day Dr. Diesel is recognized as the first worker in the field of the internal combustion engine burning cheap fuel. Now comes the Junkers engine as a radical improvement in this field. Existing engines utilizing cheap fuel oils to generate power at economies unattainable in the best compound steam engines, have left much to be desired for certain stationary and marine applications, and have been inapplicable to locomotive propulsion. The need has been for an engine which could generate cheap power from low-grade oils—down to even the asphaltum oils and their residues—not only for all stationary purposes, but for propelling vessels under practical conditions and for driving locomotives.

This need is now filled in the Junkers oil engine (Fig. 9), in which the combustion of the fuel charge in a single cylinder urges two pistons in opposite directions. The cylinder is a simple tube, open to the atmosphere at both ends—no cylinder heads, no stuffing-boxes, no valves with mechanism. The greatly superior heat efficiency, high aggregate piston speeds with low speed of each separate piston, better scavenging and cooling and lower cooling losses, and the absence of valves enable this engine to show a marked reduction of weight per horse-power—down to less than one half, in some cases one quarter—and a decided increase in efficiency when underloaded and in overload capacity. The design allows higher speeds and also a greater range of control of speed. Actual engines in use include the propelling equipment for twelve ocean-going vessels now under construction, stationary engines being manufactured by prominent European companies. At present a locomotive of 2,000 horse-power, designed for a speed of 125 kilometers per hour, and weighing less than a steam locomotive, is under construction. The field open to this type of prime mover is indicated by the fact that it consumes any cheap liquid fuel, even including asphaltum crude oils.

Without dwelling on technical details, the fundamental principle of operation of the Junkers oil engine may be understood by an inspection of the annexed schematic diagrams (Figs. 1 to 5) of a single cylinder engine—cylinder and pair of pistons, and the connecting rods and cranks of the engine in five successive positions throughout one revolution—in conjunction with the indicator card (Fig. 6).

The arrangement of parts in the five diagrams is clear on first inspection in all but one feature. The obvious features are the open cylinder without cylinder heads, the two pistons moving alternately outward, that is away from each other, and inward or toward each other, the left-hand piston *V*, being connected directly to the middle one of three cranks and the right-hand piston *H*, being connected to a cross head and a pair of parallel connecting rods to the two outer of these cranks 180 degrees from the middle crank; and the movement of the pistons, successively outward and inward, thus turning the main shaft. The object of the ports *M* and *N* will be understood as the operation of the engine is traced through one complete revolution.

The engine works on the two-cycle principle. In Fig. 1 the pistons are at the inner dead center, and the combustion space between them is filled with highly compressed, highly heated air as the result of the previous compression stroke. In this position the oil fuel is injected in a finely dispersed condition; igniting and burning under constant pressure during the first part of the outstroke (from *A* to *B* on the indicator card, Fig. 6). With the supply of fuel cut off at *B*, the working stroke continues with expansion of the products of combustion from *B* to *C*, bringing the pistons to the position of Fig. 2. At this point piston *V* is just about to open the ring of exhaust ports *M*. As the outward motion of the pistons continues (*C* to *D* on the card) the spent gases escape at about atmospheric pressure, and the position of Fig. 3 is reached, in which the exhaust ports are opening wider and piston *H* is just about to open a ring of air-ports *N*, allowing fresh air to enter and to scavenge the cylinder. These conditions are maintained until the pistons, having passed the outer dead center (Fig. 4) begin to come back on the return stroke. In Fig. 5 the inward movement of the pistons has closed both rings of the ports and the compression stroke begins on a cylinder full of cool, fresh air. The compression, *F* to *A* on the card, heats the confined air to such a temperature that the fuel, injected shortly before the point *A* is reached, ignites as it is sprayed into the cylinder.



Figs. 1 to 5.—(Reading from top to bottom) diagrams showing operation of single-cylinder Junkers engine.

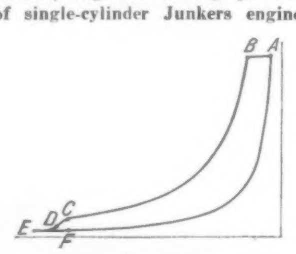


Fig. 6.—Typical indicator card.

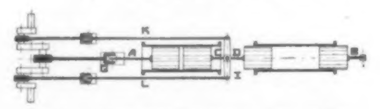


Fig. 7.—Elementary plan of two-cylinder horizontal tandem engine showing connecting-rod system for the two inner pistons operating on the side cranks.

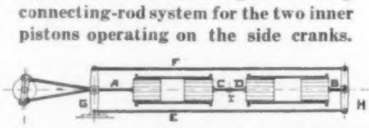


Fig. 8.—Elementary side elevation of two-cylinder engine showing connecting-rod system for the two outer pistons operating on the center crank.

The above is the complete cycle traced for a single cylinder engine of one pair of pistons. In the two-cylinder (four-piston) form, which may be built as a vertical or horizontal tandem engine with great simplicity of design, the two inner pistons move together and are linked to a single crosshead connected by a pair of rods to the two outside cranks, as shown in Fig. 7, which is a plan of the engine; the two outer pistons, which also move together, being linked by crossheads and rods to the middle crank at 180 degrees, as shown in Fig. 8, a side elevation. This construction, with two pair of connecting rods, in the horizontal and vertical planes, respectively, makes every stroke of the engine a working as well as a compression stroke.

It will be noted that the scavenging is thorough, and that both the exhaust and the former are accomplished without valves having moving parts. The compressed air for scavenging and for the fuel spray is supplied by auxiliaries driven from the connecting-rod linkage, which is extremely simple. The cylinders are simple castings, and one side of each piston is always exposed to the atmosphere and comes to rest at every outward stroke in a well-cooled region of the cylinder not touched by the products of combustion. This secures perfect cooling and lubrication. Finally, owing to the division of the total stroke between two pistons in each cylinder, a high piston speed is attained with low individual piston speeds, and a long cylinder of small diameter, most favorably adapted to thorough scavenging and to perfect combustion, may be used.

Fig. 9.—An early form of the single-cylinder Junker oil engine.

The Government Hunts Rats

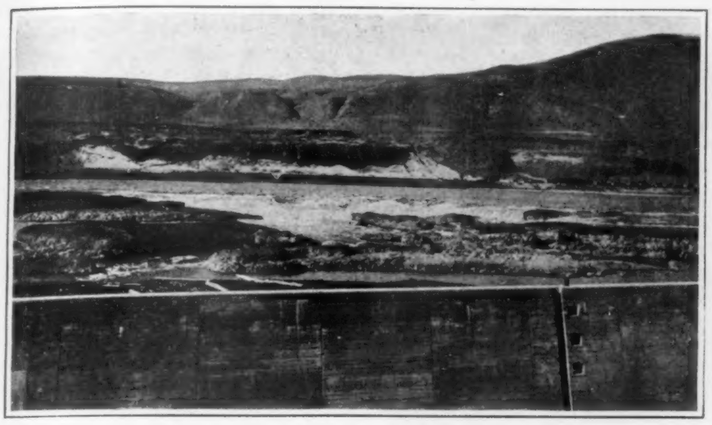
THE United States Government is conducting a hunting expedition for rats and ground squirrels, which so far has cost it considerable money for every animal added to the kill. The expedition is in charge of the Public Health and Marine Hospital Service, which has spent $1,000,000 on the killing, and is continuing the expenditure to-day at the rate of $14,000 a month.

Rats and ground squirrels were picked out for the Government's game for the reason that they are held responsible for transmitting the bubonic plague which broke out on the Pacific coast in 1907, and so effectively has the hunting been carried on that not since 1909 has a single human being in that section of the country been affected with the disease.

In connection with its work of extermination, the Marine Hospital Service has conducted experiments in the field which tend to show that rats can live an indefinite time without water. Three of the animals were put on a diet consisting of bread, meat, and cheese, but no water, and all were alive and well 60 days after the experiment was begun. On the fifteenth day one was given an opportunity to drink, but made no attempt to do so. When kept without food, but with water one rat lived three days; and of six rats deprived of both food and water, all died within periods ranging from two to five days.

"Night Wells"

A CURIOUS form of water-hole is found in the deserts of western Australia, dry by day, but yielding an abundant supply of water by night. The flow of water is preceded by weird hissings and sounds of rushing air. The phenomenon is discussed by Dr. Malcolm Maclaren, in the *Geological Magazine*, who has, however, personally located and examined only one of these wells. He found that the water supply occurred in a long narrow trench, at the bottom of which was a thin plate of gneiss, separated by a cavity from the main rock mass beneath. Apparently the heat of the day causes this plate to expand in the form of a depression, into which the water retreats. When it cools and contracts at night it forces first air and then water back into the trench.



Celilo falls. Completed section of canal in foreground.

The head of the Celilo canal.

The Celilo Canal

By W. H. Ballou

OPENING of the Columbia River to navigation from its mouth to British Columbia is a project that has been taken up energetically and may be realized within a very few years. Steamers now bring freight to Portland from Lewiston, on the Snake River, one of the Columbia's chief tributaries, but an impassible barrier is presented at Celilo Falls and the nearby rapids, where reshipment of freight is necessary.

The most important work in opening the Columbia River to traffic is now going forward at Celilo, where a canal, on the Oregon shore of the Columbia River, 8½ miles long, with 5 locks, is being built. Two of the locks will be placed at the lower end of the canal, the total lift at this point being 70 feet. Another lock at the head of Five Mile Rapids will have a lift of 11 feet. A lock at Ten Mile Rapids, which will be used at certain stages of water only, has a lift of 5 feet, while the fifth lock, at the upper end of the canal, with a maximum lift of 9 feet, will also be required at certain stages of the river.

Rock excavation for the tandem locks.

The project now under way was authorized by Congress by an act approved in 1905. The cost of the work will be almost $5,000,000. The work involves the excavation of 1,300,000 cubic yards of rock, 750,000 cubic yards of sand, 700,000 cubic yards of earth, the construction of 200,000 cubic yards of concrete and 5,000 cubic yards of rubble masonry.

The Rivers and Harbors Act of June, 1910, appropriated $600,000 for continuing construction on the canal with a view to completing it in 6 years. The new work includes the excavation of about 5½ miles and, in addition, the placing of a concrete lining in sections excavated under former contracts, as well as the designing and installation of lock gates and machinery. Maj. Jay J. Morrow, Corps of Engineers, U. S. A., in charge of the first Portland district, decided, at the time of the last appropriation, that it would be advantageous to supervise the work directly rather than let contracts, as had been done previously. This plan was approved by the Chief of Engineers, U. S. A., and First Lieut. Henry H. Roberts, Corps of Engineers, U. S. A., was at once placed in local charge of the entire project, involving the completion of contracts already in effect, and the completion of work by hired labor. The organization of affairs required some little time, but construction work was gotten under way in October, 1910, and it has proceeded steadily ever since.

In prosecuting the work, careful tests have been conducted by the officers in charge, to determine the qualities making for the best results, and materials have been placed in the work strictly on their merits. An odd feature is the maintenance of a sand-crusher plant, whereby stone rejected from the rock crushers, which crush rocks for concrete, are reduced to sand. This is somewhat singular from the fact that there are sand dunes nearby where this material could be secured; but it is found that by manufacturing it, its cost is not only reduced, but the tests show it to give a greater tensile strength to concrete than any natural sand available for the work.

The Columbia River Valley is one vast granary, and in autumn great piles of wheat sacks are placed at railroad stations and river landings awaiting shipment to the Portland market. Great economies in transportation will be effected if this great tonnage of wheat can be placed on board steamers and floated down stream all the way to Portland. This is ideal transportation, effected at the least possible cost. At present a portage railroad at Celilo transports freight, both up and down the river, past the places in the stream impossible of navigation. This additional hauling of freight is expensive and causes delay.

The canal work is expected to be finished not later than 1916, and when this is accomplished the wheat, hay, fruit, and much of the livestock, which comprise the chief staple products of the Inland Empire, will find an ideal outlet to Portland, and thence by water or by rail to the markets of the world.

Instrumental Observation of the Sun's Heat

By the Paris Correspondent of the Scientific American

THE instrument which is being used by Dr. J. Dupaigne in France for observing the heat of the sun presents several interesting features, one of these being a thermometer made with a hollow conical bulb. The aim is to have the sun's rays fall upon a cell or absorbing chamber so that the effect of the rays will be thus concentrated. An ordinary thermometer, even though blackened, will always reflect a good part of the rays, and these will be lost. Dr. Dupaigne had the idea of making a combined cell and thermometer. Instead of using a solid bulb, he makes a double-walled one in such a way that the mercury is spread around in a thin layer just as it would appear if put between a double funnel, and the stem of the funnel extends as a tube so as to form the thermometer. When the sun's rays fall into this conical-shaped cavity (*A* in the diagram, Fig. 1), which is blackened so as to absorb them, they are not reflected again, as they are caught by the sides of the narrow funnel, which has a 30-degree angle. This principle is due to M. Féry, but Dupaigne here applies it to a thermometer for the first time. This is placed inside a Dewar double-walled and silvered globe so that the bulb cavity is turned toward the sun's rays and the long stem of the thermometer extends to the rear. The globe acts so as to prevent loss of heat. In this way the user is able to estimate the heat of the sun under the best conditions. It is the quantity of heat and not the temperature which is measured, and such an instrument is a special form of calorimeter, here shown in Fig. 2 and named actinometer.

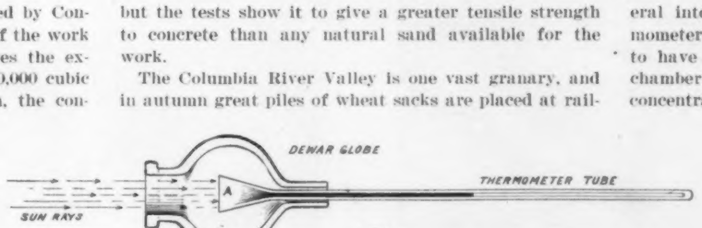


Fig. 1.—Diagrammatic illustration of the method of absorbing the sun's rays, so caught by the sides of the blackened hollow cone A that they cannot be reflected and lost. The lower sketch is an enlarged view of the cone or funnel.

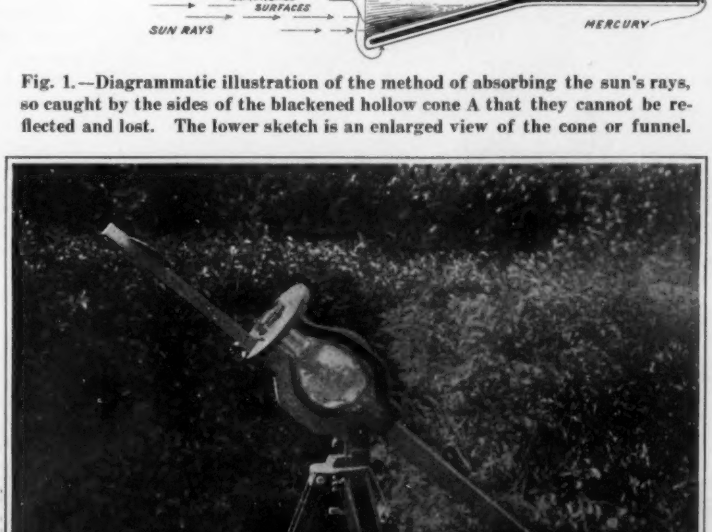


Fig. 2.—The actinometer in position to receive the direct rays of the sun.

Night Letters in Italy

A NIGHT letter service similar to that which has become so popular in the United States and Great Britain has just been adopted by the telegraph system of Italy (a state institution). According to a law recently passed this service is, for the present applicable to a list of designated places. A uniform charge has been adopted of 2 centesimi (about $0.004) a word, with a minimum charge of 60 centesimi ($0.116).

Burning Up Bad Roads to Make Good Ones

By C. H. Claudy

GOOD roads present many different problems in different localities, according to the building material at hand and the character of the soil. Perhaps no more difficult conditions for the making of good roads exist than in the lowlands of the Mississippi Valley, where centuries of swamps and tons of decayed vegetable matter have incorporated in the "gumbo" or "buckshot" clays of that region a plasticity and mud-making ability which produce the worst "roads" in the world.

During certain seasons of the year, these so-called "roads" are absolutely impassible, vehicles sinking to the hubs and horses getting so mired that they must either be shot or dragged out with ropes, often with broken legs to pay for their drivers' temerity.

To make a good road out of this "gumbo" is a problem, the importation of sand for a sand-clay mixture is too expensive, and there is not enough rock in these localities to make a hitching stone, let alone a macadam road. But a solution of the problem has been found in the "burned clay" road, in which the "gumbo" is so changed in character by firing as to present a fairly hard and mudless surface, even after a heavy rain.

Burned clay properly spread ready for leveling by rolling.

The "gumbo" clay is black from the large percentage of organic matter it contains, and from the same reason is peculiarly sticky and plastic. But after having been baked, it forms a clinker, which, while not rock-like in its hardness, shows no tendency to form mud when mixed with water. This surprising fact is made use of by the farmers living in the "gumbo" regions, to make the "burned clay" road. Luckily the districts of "gumbo" are heavily wooded, and fuel is cheap and does not need to be hauled. The process of making a "burned clay" road is as simple as it is novel. The width of the road is determined, and it is ditched on either side. Next the surface is plowed up as deeply as possible, and even four mules make a hard job of dragging one plow through the sticky clay. The plowed up clay is then thrown into furrows across the road, making ridges about four feet apart. Cord wood is laid closely across the tops of these ridges, making a wooden floor above the clay, the furrows and ridges forming flues. Fire wood is piled irregularly on this wooden floor, with masses of clay filling in the open spaces. A second course of cord wood is laid on top of this mixture of wood and lumps of clay, and all openings filled with kindling and light wood. The whole is then covered with a clay blanket—usually taken from the ditches on either side—to a depth of a foot, and tamped and rounded off so that the heat may remain in the mass as long as possible. Where coal slack is available, it is often substituted for wood. The point is to get heat regardless of what fuel is used.

Showing the method of preparing the road for burning. All ready for firing.

Making a burned clay road. The burning of the layers of wood and clay.

When completed, the flues are fired so that they will get the draft down wind. The workmen pay careful attention to the burning, and when any part of the fire seems to slack up, reinforce that flue with light kindling, so that an even burning is maintained throughout the mass.

When the wood is all burned—the organic matter in the clay aiding the combustion and in giving off heat—and the mass sufficiently cool, it is found that all the clay on the first floor, all the clay on top, and even the ridges of clay between the furrows, as well as underneath the lowest fire, has been thoroughly clinkered.

A burned clay road, two years old, photographed just after a hard rain.

To make the loose mass into a road, nothing is needed but grading with plow or scraper to make a high crown in the center and a final compacting by rolling.

The result is a hard surface road which refuses to get muddy, which wears well, costs next to nothing to repair, and which provides a safe bridge through "gumbo" country. On either side of the roads all winter long, no carriage could roll—on top of the six to eight inches dressing of burned gumbo clinker, heavy wagons travel without difficulty.

The cost of such a road varies between $1,000 and $1,500 a mile, a very small price to pay for a good road, and particularly in a district where, until the coming of the "burned clay," transportation except by railway was, in the winter time, an absolute impossibility.

Salving the Steamer "Jose"

THE fruit steamer, "Jose," lay at her dock in the East River, New York, taking on a cargo of case oil and gasoline for Central American ports when a serious fire broke out. The vessel was towed out into the stream to prevent the fire from spreading to the dock and other shipping. The fireboats pumped such a deluge of water into the vessel that it sank off shore in thirty-eight feet of water. This happened on the 13th of March of this year, and it was not until the last of July that the work of raising the vessel, pumping it out, and delivering it to the owners could be completed. The wreck could not have been sunk in a more unfavorable position. The bottom on which it lay was covered with boulders which, at that point, formed a pocket about eight feet deep. This meant that the vessel would have to be raised at least ten feet before it could be towed to a position more favorable for the wrecking operations. The "Jose" lay right in the path of shipping, and at a point where the tides were so strong that work was actually limited to the period of slack water at high and low tides.

The task of raising the steamship was undertaken by the Merritt & Chapman Derrick and Wrecking Company, and the method they employed is pictured in our front page illustration. While the method is not a new one, we believe that our readers would be interested in learning just how such work is done.

The wrecking outfit consisted of six pontoons, three on each side of the sunken vessel, and two barges, the latter furnishing the steam for the pumps on the pontoons. The pontoons were provided with chain wells of the form shown, partly broken away in one of the detail views. The wells were of flat triangular form, flaring out at the bottom, which was open to the water, so as to allow for the sweep of the chain. There were four such wells to each pontoon, and the chains passed from the pontoons on one side of the vessel under the hull and to the pontoons on the other side. Beside each chain well, there was a mast which was provided with fall and tackle by which the slack of the chain was taken up. The chains as they emerged from the wells passed through planks fulcrumed at one end, and arranged to be lifted by hydraulic jacks at the other end. The chains, after being drawn up taut by the tackle, were fastened to the planks by means of toggles, or U-shaped pins, fitted under the chain links, and then hydraulic jacks were operated to secure a uniform tension.

As the pull of the wreck on the chains would tend to cause the barges to come together, they were kept at the proper distance apart by means of beams known as "spreaders." There were also top timbers that ran across the wreck from pontoon to pontoon, and were fastened to the pontoons by means of chains that passed around their hulls, as shown clearly in one of the detail drawings. These served to keep the pontoons on an even keel.

Had the "Jose" rested on a soft bottom it would have been a simple matter to pass the chains under it. They could have been lowered under the bow and then worked back and forth until they reached the desired position. But as the wreck rested on boulders, such a course was impossible. It was necessary to get the chains under at fixed points corresponding to the position of the chain wells on the pontoons, and this necessitated in many cases the blasting of a channel under the wreck, through which a small chain could at first be passed, and then be used to haul a heavier chain through. The divers could not work at the bottom when the tide was running, as it was strong enough to sweep them off their feet. In the short intervals of slack water, but little could be accomplished, and so the work dragged on through several months. There were a number of delays, due to snapping of the chains when the pontoons were rocked by swells. As the wreck lay in the path of navigation there was much apprehension whenever any large vessel passed by. However, the regular sound steamers very considerately reduced their speed when passing the wreck so as to prevent any accidents. The chains were also crushed by contact with the boulders as the vessel was moved over them.

Although the task of passing the chains

(*Continued on page 187.*)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Suggestion for Typewriter Makers

To the Editor of the SCIENTIFIC AMERICAN:

I would like to suggest that the manufacturers of typewriters adopt a keyboard that would be best adapted for the touch method of operating and all of them manufacture the same.

This would standardize the typewriter like musical instruments, most notably the piano and would be of convenience to people in obvious ways.

Santa Ana, Cal. B. T. BAKER.

The First Parachute Drop from an Aeroplane

To the Editor of the SCIENTIFIC AMERICAN:

We beg to call your attention to an error in your issue of July 6th, on page three, under heading of "Aeronautics," in which you state that the first parachute drop from a flying machine was made by Law. For your information we would like to state that the first successful drop from an aeroplane was made by Bert Berry in a Benoist biplane, driven by Tony Jannus, at Jefferson Barracks, Mo., February 29th, 1912. You can find an account of this in any of the New York papers the day following, as this attracted universal attention, and was taken up by many of the foreign papers, the *London Graphic* carrying photographs on the complete front page. We are inclosing herewith a description of this taken from *Aero* of March 9th. THE BENOIST AIRCRAFT COMPANY.

St. Louis, Mo.

Determination or Free Will?

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of August 17th, 1912 a Mr. Paul R. Birge makes this rather startling, positive and dogmatic statement: "From the deterministic, the only thoroughly scientific standpoint, there is no line separating responsible wickedness from acts against the public peace which have their origins in perversities, etc."

He here out-Haeckels Haeckel in making a statement, which, to the hasty reader, would pass for a scientific truth grounded upon fact while in truth he has not proved the statement. What is science? The following is Huxley's definition (see "Value of Natural History Sciences," Lay Sermons, page 73): "Science is nothing but trained and organized common sense."

Prof. Haeckel says in brief on page 6 of "The Riddle of the Universe:" "All purely scientific investigations consists of: firstly, experience; secondly, inference."

Is determination proved from experience? It is not. In fact all experience and common sense is for the freedom of the will. We make a practical application of it every day. As Doctor Johnson says, "Sir, we know our will is free and there's an end on't; all theory is against the freedom of the will; all experience for it."

As determination cannot be proved from experience, according to the above definitions of science, it is therefore not a thoroughly scientific standpoint. Theories that are not grounded upon the facts of experience have no right to be called scientific, still less to be called thoroughly scientific and the only scientific standpoint.

I wonder which is the more scientific, determinism or Free Will?

Washington, D. C. C. H. K.

Bow-on Collisions

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 17th, under head of "Danger of Bow-on Collision," your Californian correspondent seems to have entirely overlooked the fact that the strength of the plates which compose the hull of an ocean steamship as compared with the total weight of the ship are an almost negligible quantity.

He says "when the forward motion of a ship is *suddenly stopped* nothing whatever could hold the boilers and engines from breaking loose and going forward and smashing the bulkheads and probably the bottom," and then he pictures the horrible results from the breaking of the steam pipes.

Now anyone with the least amount of practical knowledge of the strength of material knows that such conditions are impossible.

A big steamship, as a whole, cannot be instantly stopped because the force of any blow that may strike the outside of the hull will be taken up by the successive crumpling of the plates, so that in a very large ship scarcely any jar would be felt in the middle of the ship, as was, in fact, noted by the passengers on the "Titanic."

Such results as your correspondent imagines could only occur if the ship were built of so great strength as to be virtually one solid body, but as such a ship could not float at all, the conditions are impossible.

The reason why no notice was taken by any newspaper of the letter which Mr. Prosser sent to the Investigating Committee is self evident, for it seems to be a waste of space for any paper to publish so absurd a theory.

Gloucester, Mass. REUBEN BROOKS.

The "Akron" Accident

To the Editor of the SCIENTIFIC AMERICAN:

We have noticed with interest the various reports which have appeared in the SCIENTIFIC AMERICAN, as an attempt to explain the explosion of the dirigible balloon, "Akron," at Atlantic City, on July 2nd. We find it necessary to correct a few points on which you have apparently been misinformed. It is true, to a certain extent, that the "Akron" showed no speed lines. It was not built for them. It was built according to the specifications which we received, and corresponds exactly to them.

The rudder was not small, although perhaps not quite properly balanced, and required too many turns of the wheel to move it.

The "Akron" was equipped with aeroplane surfaces of about sufficient size to give a reaction of about 1,000 pounds either up or down. Such a reaction would be sufficient. There was only one pair of orientable propellers, driven by the central power plant. There were U-tube pressure gages from all the ballonets and from the gas compartment.

The hydrogen used was exceedingly pure, and tests showed that the fabric had suffered practically no deterioration from this or any other cause.

You may be interested to know our views in the matter.

There was no representative of the Goodyear Tire & Rubber Company in Atlantic City to witness the accident, and, consequently, we must base our conclusions on the various and some times conflicting reports of those who were eye witnesses, and upon the investigations which we have made as thoroughly as possible of the remnants of the wreck.

The wreckage was raised from the water at considerable expense, and its condition carefully noted. Sample pieces of fabric were tested out, and all possible tests made that could in any way throw any light on the cause of the accident, and probable reason for it.

We regret that our statement, from the very nature of things, cannot be as explicit and satisfactory as we would like to have it. However, we will give it to you for what it is worth, and from it you can draw your own conclusions. We have made it out in the form of a general discussion of all the theories of the possible cause of the accident. It is hard to tell which one is the most plausible.

In thinking of the dirigible balloon "Akron," kindly remember that the gas bag only was constructed by the Goodyear Tire & Rubber Company, and that, according to the general specifications and suggestions of Mr. Vaniman. The car and the entire work of assembling was carried on at Atlantic City under the direct supervision and direction of Mr. Vaniman. We believe strongly in the future of the dirigible, considering it only a matter of time before its development in this country will equal and surpass its development in Europe and other foreign countries. We believe that this accident contributed a great deal to the science of the manufacture and operation of the dirigible balloons.

We are ready to construct dirigibles of any type, and will welcome anything that you can do to assist in bringing the dirigible to its successful completion in this country.

Any and all of this letter is for publication if you so desire, for we are willing and in fact wish everybody to know the true facts of the case. We are glad to furnish any and all information which we can, which will in any way throw any light on this unfortunate accident, and aid the science of aeronautics.

Unfortunately a complete examination of the gas bag was impossible, as a large part of it had been cut up and carried away as souvenirs, before it could be protected. Our complete report is as follows:

A large number of witnesses were investigated, whose accounts vary greatly as to detail, but the following summary covers the points on which reliable eye witnesses agree and which we have determined from our investigations.

The balloon started directly away from the hangar, and holding its course, proceeded to a point over Brigantine Beach, then made two wide circles, and was making the third when the accident occurred. The ship was rising during the whole time that it was in the air, and had attained an elevation of about 2,500 feet.

Shortly before the bag collapsed the bow of the ship seemed to be pointed downward and the orientable propellers running, apparently in an effort to bring the ship down to a lower level. Accounts vary as to the exact method of collapse of the bag but the general opinion is, that the rent in the bag occurred near the stern; the ship was almost on an even keel, and poised a moment in that position, then the stern sank and she plunged downward; when part way down the greater portion of the bag tore loose from the car; the car shot downward stern first in a nearly vertical position until almost down to the water, when it swung around, partially righting itself, then stuck stern first in nearly its normal position. The portion of the gas bag which had been torn loose, dropped into the water a short distance from the wreck, and floated up the channel with the tide.

There have been several theories advanced as to the cause of the accident.

(1) *Fire or explosions.*—There was no evidence confirming this theory, the tanks, while battered up and more or less broken to pieces, showed no signs of having been ripped open by an internal explosion. All the motors were recovered but the small one and the cylinders found to be intact. Some of the bodies were burned, but the doctor who examined Calvin Vaniman stated that these burns were probably made by hot liquid of some kind (presumably hot water from the radiators) and not by hot iron, burning gasoline, or by flame.

A violent explosion of gas would have been impossible. Recent tests of the gas showed it to be over 80 per cent pure hydrogen, although the balloon had been inflated nearly four months. There was no signs of fire discovered on any part of the balloon except one small spot on the fabric, which had evidently come in contact with a hot pipe. A few reports of smoke and flame having been seen are current, but most witnesses, particularly those familiar with the operation of gasoline engines, say that the smoke was only the exhaust from the engine, and that there was no flame.

(2) *Rupture of gas bag due to internal pressure.*—There are many stories current as to the gas bag being made of under-strength fabric, or that it rotted from exposure, or from impurities in the gas. The facts are these:

Mr. Vaniman specified in his design a maximum pressure corresponding to 1 inch of water. The balloon was actually built to stand an ultimate pressure of 8 inches, thus giving a safety factor of 7, which considerably exceeds the usual figure. But there was reason for this excess strength. It was to be an experimental machine of rather a novel design, and the first ever made in this country. Likewise, Mr. Vaniman, although a great inventor and genius in his way, had not had the long practical experience with dirigibles which is given the European pilots, and which insures their doing the right thing at the right time. As to the fabric being rotted by the gas, or otherwise, it is sufficient to say that samples cut from different parts of the bag after the accident, showed no material deterioration in strength. All seams were triple reinforced and showed far over the 100 per cent efficiency as recorded by the numerous tests. Although, on account of the souvenir hunters it was impossible to tell where the bag had first broken, it is manifest that no seams (so far as observed) had been even strained.

In spite of the extra strength, the balloon could very easily have been burst by letting the pressure go up to an excessive amount. It would take a fabric 50 times as strong to resist all the expansion likely to occur from the sun's rays and it would be impossible to resist that due to increasing altitude. There is some slight evidence which seems to point in this direction. It was morning, the sun was getting hot and the balloon was rising at the time of the accident. Only the two rear engines were running. There were scalds on Mr. Vaniman's body which would indicate that something had called him to the rear of the car, away from the pilot's bridge where the pressure gages were located. He had a large automatic safety valve of French manufacture, which should have been ample to take care of just such an emergency, but we found on examination that he had provided it with extra springs since the first flight, which did not allow it to open fully. On the other hand the bottom of the bag was made purposely weaker than the top so that if it did burst it would in all probability retain enough gas to let the machine down in safety.

(3) *Breakage of the suspension ropes.*—This theory has not to our knowledge been advanced before, but it would well explain all the observed facts and has strong evidence to recommend it. The size rope used for supporting the car gave a nominal safety factor of only about three (3), and they had been tightened up much beyond their proper allowance. We have it from two of the mechanics that these ropes had been breaking frequently when simply standing in the shed. If two or more of them happened to break at once, all the others would speedily follow suit, thus throwing all the strain on the bottom fabric, tearing it open and ripping the whole bag from the car.

Propeller breakage.—This also seems a plausible theory. We regard it as practically impossible that a propeller could have broken from centrifugal force alone. They were of wood, run at a slow speed, and were specially designed for the work by a reputable French concern. If, however, any part near the one broke, a suspension rope for instance, a blade striking it, would be easily broken off and might fly into the gas bag in such a way as to cause a fatal rupture.

While we deplore the fact that it was impossible to determine the exact cause of the accident, one may well take satisfaction in the fact that all the accidents outlined above are entirely preventable.

In the meantime, we cannot appreciate too much the work of those who went to their death for the cause that is yet new, and which, like everything new, demands more than its share of money and lives.

THE GOODYEAR TIRE AND RUBBER COMPANY,

Akron, O. *Aeronautic Supplies Department.*

Fig. 1.—Menhirs at Chenat.

Fig. 2.—The rocking stone at Boussac.

Fig. 3.—The Urbe Dolmen.

Curious Megalithic Monuments of France

By Jacques Boyer

WE will not commence this article with a minute study of the 4,458 dolmens and roofed alleys which the French Commission of Megalithic Monuments has recently catalogued; but we will simply, in the first place, glance at these imposing relics of prehistoric times, that are doubtless contemporary with the menhirs, colonnades and cromlechs, which we shall speak of later.

According to the definition given by Bonstetten and generally adopted by archæologists, a dolmen is a monument of stone, bare or covered with earth, and of dimensions sufficient to contain several tombs. It is constructed of a variable number of rough flat stones supported in a horizontal position by a variable number of stone pillars. The number of pillars may be only two, as in the dolmen known as the Merchants' Table at Locmariaquer in Morbihan (Fig. 5); three, as in the Pierre-Levée at Brantôme in the department of Dordogne (Fig. 6); four as in the Urbe dolmen in Creuse (Fig. 3), and the Roche-aux-Loups at Beaumont in Dordogne (Fig. 7), or a still larger number.

If the dolmen contains many pillars supporting several entablatures, it is called a roofed alley.

An exceedingly fine specimen of this class, the Roche-aux-Fées (Fairies's Rock), is still seen standing near Rétiers in the Department of Ile-Ste. Vilaine.

The megalithic monuments are not evenly distributed throughout France. They are rare in the east and southeast, except in the departments of the Aube and the Alpes-Maritimes, according to the statement of Joseph Déchelette in his "Pre-historic Archæology" (1908). They are found most abundantly in a zone included between the Breton Coast of the English Channel and the Mediterranean shores of the departments of Gard and Hérault. Two very compact groups may be distinguished: the southern group, including the five departments of Ardèche, Aveyron, Gard, Lot and Lozère; and the western or Breton group, which is most densely aggregated in Finistère and Morbihan.

The attentive study of the dolmens and roofed alleys shows that their builders placed the large entablature stones with their plane faces downward or inward, paved the floor below with smaller flat stones and, in general, filled the interstices with still smaller stones. Some of the pillars and roof stones are so huge that it seems almost impossible that they could have been transported and assembled in the infancy of civilization with the aid of rudimentary tools, especially as some of these stones have evidently been transported to considerable distances. For example, a stone weighing 40 tons, found at Perotte has been moved 19 miles and one at Moulins 22 miles.

The method employed by these prehistoric builders are entirely unknown to us; but experience has demonstrated the possibility of transporting and erecting very heavy masses without the aid of complex machinery or even of ropes. The stone can be raised by means of a series of levers and supported by placing earth beneath it. After the block has been raised to a certain height it can be allowed to glide down a sloping bank of earth plastered with clay, and by repeating these operations, the stone can be transported to an indefinite distance. Possibly the cave dwellers made use of ropes and of round logs, rolling on a path paved with smaller logs or planks. Whatever method was employed, the construction of the megalithic monuments required a spirit of order and discipline.

(*Continued on page 185.*)

Fig. 4.—Menhirs at Lampary.

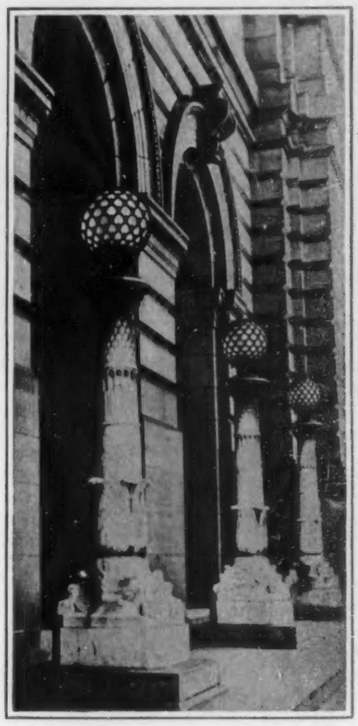
Fig. 5.—The merchants' table at Locmariaquer.

Fig. 6.—The Pierre-Levee at Brantome.

Fig. 7.—The Roche-aux-Loups (Wolves rock) at Beaumont

The effect of acid rainwater on a galvanized water pipe of cheap Bessemer steel in service about five years.

Hand-fired boilers, showing production of smoke by careless and uneconomic firing. Loss of efficiency is probably between 19 and 15 per cent.



A besmirched monument.—Carved lampposts in front of Carnegie library, showing soot discoloration.

Smoke, the Destroyer

By R. C. Benner, Ph.D., University of Pittsburgh

According to the smoke inspector of Chicago, the black fumes belched by the chimneys of his city cause an annual loss of fifty million dollars in ruined merchandise. Since one third of the American population lives in cities, the United States Geological Survey estimates, on the basis of this smoke inspector's figures, that the total loss caused by soot reaches a dizzy total of six hundred million dollars. Here is indeed a problem for the scientist. That he has not neglected his opportunity is evidenced by the following article, which, written by the chemist in charge of the University of Pittsburgh's smoke investigation, shows exactly to what the destructive action of smoke is due.—Editor.

It may seem surprising that an architect should specially interest himself in the purification of the air, but the problems confronting him in the designing of buildings to be erected in a smoky town are so manifold as to make a clean atmosphere a matter of moment. For architecture does not depend upon a knowledge of materials alone, nor upon designs of beauty alone, but is very dependent upon the atmosphere, and when smoke pollution is taken into account one has much to contend with.

Soot possesses the properties inherent in itself for making the worst possible kind of dirt.

1. Finely divided carbon forms the basis of our best black paints. It is opaque and has a large covering power, i. e., a little will make a large surface dirty.

2. It contains tar, which, as well as being black and corrosive, causes the soot to stick to any material with which it comes in contact.

3. Finely divided carbon has a great absorbing power, absorbing large amounts of the sulphur acids, more especially sulphurous and sulphuric, with minor amounts of hydrogen sulphide.

No wonder that our houses look grimy and miserable and that the use of skylights in many places is made impossible, while in others it is necessary so to arrange them that they may be readily cleaned. Otherwise they would soon become useless because of the accumulation of soot.

Again, changes in design so as to make a different arrangement of drain pipes, etc., are, at times, necessary in order to prevent the splashing of rainwater containing soot upon the building.

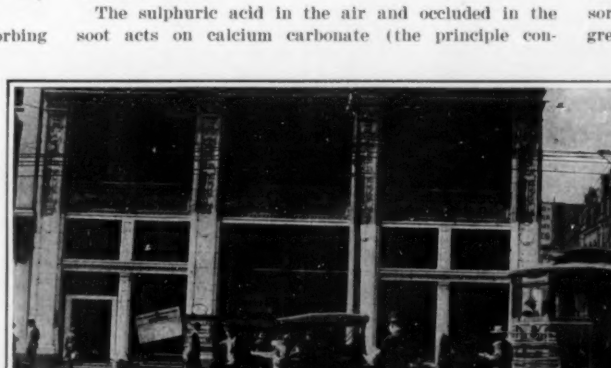
In a smoky city, too, much more glazed tile and vitrified brick is used for the outside of buildings, as it makes the cleaning a comparatively simple matter, washing alone being necessary. Building stones, such as limestone, marbles or sandstones, with calcareous binding material are rapidly disintegrated by the acid in the soot and the air. Therefore, materials such as granite, sandstone (with a silicious binding) brick, etc., which are not attacked by the sulphurous and sulphuric acids in the soot, should be utilized. But, unfortunately, that stone which is most easily affected, disintegrated by the atmospheric acid and decolorized by soot, is the one which it is easiest to work into the desired shape for building purposes. Granite and similar stones, which are practically unattacked by acid and impervious to moisture, consequently offering little chance for the soot to lodge and readily cleaned, are extremely expensive because of the difficulty in working. Thus the architect finds himself confronted with monetary considerations.

In Glasgow, several years ago, the subject was widely discussed and various remedies were advocated, i. e.: Painting the stone with paraffine, similar to the treatment given the Obelisk in Central Park, New York, and covering with solutions of soap and alum, silicate of soda, carbonate of baryta, etc., and also patented preparations. These are all more or less effective and tend to reduce the evil effects of the acid and soot to a minimum by closing the pores of the stone. Sand blast is used for cleaning in some places, but this abrades the surface, leaving it rougher than before.

Hydrochloric acid is utilized for washing down stone walls, but it must be used with care, as discoloration is likely to follow. Cleaning the stone is at least but a temporary expedient and represents a periodic tax on the owner. The logical thing is to make cleaning unnecessary by water-proofing the stone and doing away with the smoke.

The sulphuric acid in the air and occluded in the soot acts on calcium carbonate (the principle constituent of stones most readily corroded by the acid in the soot), and forms calcium sulphate (gypsum), which is more readily soluble in water than the calcium carbonate but, at the same time, causes the stone to undergo a physical change, making it swell and become porous and friable and easily disintegrated, also roughening polished surfaces, thus making them more susceptible to attack by acid and moisture and also easily affected by weather.

Dr. Angus Smith has found mortar to contain 28.33 per cent of sulphuric acid, equivalent to 48.16 per cent $Ca\ So_4$ caused from the action of the sulphuric acid in the air on the calcium carbonate. Limestone and marbles have been found to contain 0.52 to 3.85 per cent $Ca\ So_4$, and because of the comparative ease with which this substance is soluble in water, the surface is readily eroded. The effect of the sulphuric acid absorbed in soot is rather marked on most metals and greater than the action of a like amount of acid in the rainwater or air. It would seem from observations taken in Pittsburgh that soot containing acid adheres to the metal by means of its tar content and forms an electrolytic couple, thus making corrosion much more rapid. In the case of iron and aluminium, the oxide (or basic sulphate) is produced, at least in part, from the sulphate, and the acid is used over and over again.



Lower story of Keenan Building after it had been washed down. This story is cleaned twice a year.

To experimentally verify these observations, duplicate sets of various metals were fastened to two boards. One set was protected from the soot in the air by means of cheese cloth, yet still exposed to the air and the rain. The other set was left unprotected from the soot and it shows a much greater amount of corrosion.

The following figures obtained by Messrs. W. B. Worthington and A. Rattray, show the accelerating effect of the acids in the air. Quoting from Cohen, "A number of rails were placed in suitable positions by the side of the line, and weighed at intervals and the loss of weight recorded. The rails were of the ordinary railway section weighing 86 pounds per yard." The annual loss of weight from corrosion was as follows:

	Loss in weight in pounds per average year.	No. of years of observations.
1. In the center of the town	1.04	17
2. In adjoining place in smoky tunnel.	1.48	13
3. In a wet place in same tunnel	1.71	8
4. On the seacoast among sand hills	0.18	17

Painting Exchange National Bank. This old iron front, one of Pittsburgs structures, is given two coats a year.

The question of exterior and interior decoration is one affected as much by the amount of smoke in the air as by the tastes of the owners of the building. Interior

(Concluded on page 186.)

The Heavens in September

Indications of the Sun's Motion Through Space at 12 Miles per Second

By Henry Norris Russell, Ph.D.

WE considered last month some of the conclusions which might be drawn from a study of the motions of the stars in Scorpius and Sagittarius; but we were far from exhausting this topic.

The diagram, showing the amount and direction in which each star will move in the next hundred thousand years is reprinted here, and, for comparison, a second is given exactly similar in nature, but exhibiting a portion of the northern heavens (now visible in the evening sky), in which the constellations Lyra, Hercules and Corona Borealis may at once be recognized.

Each illustration shows all the stars in the given region which are brighter than the fourth magnitude, with the addition of a few slightly fainter ones to mark certain familiar constellation figures.

It needs only a glance to see that there are very marked differences in the way in which the stars in these two regions of the sky are moving. In the vicinity of Scorpius almost all the stars are moving southward and westward (that is, downward and toward the right on our diagram). This applies not only to the stars of the moving cluster which we described last month (which are all going in the same direction and at the same rate), but to the remaining stars, which though moving in different directions and at different rates show the tendency to move downward in all but two cases out of sixteen, and a distinct, though less overwhelming tendency toward the right.

In the region of Hercules the situation is quite different. Hardly any two stars are moving in the same direction or at the same rate, and motions to the right or to the left, up or down, occur with an entire lack of system, while four stars are moving so very slowly that even in 100,000 years they will not have changed their position by an amount great enough to show on the diagram, so that they appear simply as dots with no arrows attached to them.

In the first region we have some approach to order in the stellar motions; in the second we find chaos. It may seem at first sight surprising that it is the order, and not the chaos which demands explanation; but we must remember that the stars which seem to us to be neighbors in the sky, and to form a definite configuration have usually no real connection at all; some are many times as far away from us as others, and they only seem near together because they are nearly in line with one another from our particular point of view. We need not, therefore, expect to find the stars of a given constellation moving in the same direction, much less at the same rate, and, unless we can show some definite reason to the contrary, we may expect to find as many going northward as southward, and eastward as westward.

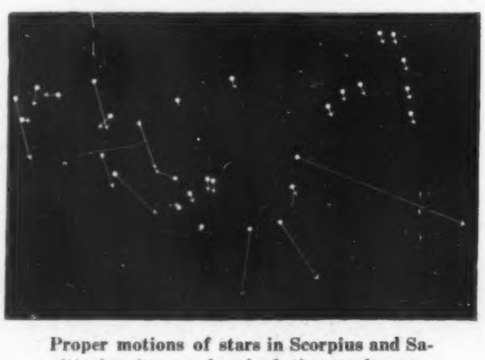
This is just what actually happens in the region of Hercules, and we may, therefore, rest content to ascribe what we observe there to mere chance.

Something more than chance, however, determines the apparent *rate* of the stars' proper motion. Of two stars, each of which is really moving (at right angles to our line of sight), at the same number of miles per second, the nearer one will seem to move the faster, in direct proportion to its nearness. It is, therefore, likely that the stars which have the largest proper motions are the nearest to our system. But this is by no means an infallible test; for a star whose actual motion, in miles per second, is very rapid, will seem to move fast, even if at a considerable distance. In spite of such exceptions, it is undoubtedly safe to assume that the stars whose apparent motion is rapid are, on the average, much nearer than those which seem to move slowly.

These principles are well illustrated by the four fastest moving stars shown on the Hercules diagram. They have all been repeatedly observed for parallax, and the results show that they are all relatively near our system.

Zeta Herculis (shown in the upper right-hand part of the figure) is the nearest, its distance being about 23 light-years. Next come μ Herculis and Vega (the two rapidly moving stars in the left-hand half of the diagram), whose distances are 31 and 35 light-years, according to the latest observations. The star of largest proper motion of all in the region, γ Serpentis, appears to be farther off, about 60 light-years (according to the mean of three measures of its parallax, which do not agree as well as in most cases). Its actual rate of motion must be much more rapid than that of the other stars. But why do the stars in Sagittarius behave so different? It may still be true that those which seem to move fast are, on the average, nearer to us than the others; but this does not explain the general southerly drift of all the stars in the region. If this peculiarity was confined to the constellation we might be content to say that the stars in this particular part of the heavens had a peculiar tendency of their own; but much the same thing, though not to quite so marked a degree, is found in most parts of the sky. There is a distant preference, among the motions of the stars for a certain quarter, and an avoidance of the opposite quarter. The favored directions run by no means at random. They all point away from the region of Hercules and Lyra, and, toward that of Canis Major.

Proper motions of stars in Hercules, Corona and Lyra in one hundred thousand years.



Proper motions of stars in Scorpius and Sagittarius in one hundred thousand years.

Our Sun itself is the seat of the motion, and is steadily progressing through space, like the other stars, carrying all its attendant planets with it. The apparent drift of the heavens is the reflection, if we may so speak, of this motion of our system toward Hercules.

In either of these regions the influence of the solar motion changes only our distance from the stars, without influence upon their apparent motion across the sky, and we get a chaos of proper motions with no marked preferences. But when we look out nearby at right angles to the motion of our system, as is the case in Sagittarius, the apparent drift is at a maximum, and only those few stars which are going the same way as the Sun, but faster, appear to move opposite to the general run of the stars. It need hardly be added that this hypothesis of the Sun's motion has been fully tested, and the proof clinched by spectroscopic observations. The average rate at which we are growing nearer to Hercules, and farther from Canis Major, is twelve miles per second, which must obviously be the rate of the Sun's motion in space.

The Heavens.

The regions of the sky of which we have spoken are both visible in the early evening, though by our hour of observation a part of the southern one has set. We may still find Sagittarius near the southwestern horizon, and, passing northward over Ophiuchus, recognize Corona, Hercules, and Lyra a little north of west, the last high up toward the zenith. Cygnus is still higher, practically overhead. The Great Bear is low on the northwestern and northern horizon, with Draco and Ursa Minor above. Cassiopeia and Cepheus are above the pole, and below the former, in the northeast, are Perseus and Auriga. Taurus is rising, and Cetus occupies the southeastern sky. Above these are Aries and Pisces, then Andromeda and Pegasus. Aquarius and Capricornus occupy a wide dull region in the south. Lower down is the bright star, Fomalhaut, in the Southern Fish, and still lower the constellation of the Crane well visible only in more southern latitudes.

The Planets.

Mercury is morning star all through the month, and is well observable about the time of his greatest elongation on the 7th, when he rises only a little after 4 A. M. He is in Leo, and passes about five minutes of an hour north of the bright star Regulus on the morning of the 10th. This will be an interesting conjunction. The planet is much the brighter of the two, exceeding the star about five-fold.

Venus is evening star in Virgo, and may perhaps be seen low in the twilight in the latter part of the month, when she sets about 6:40 P. M. Mars is also an evening star, theoretically, but is too near the Sun to be observable.

Jupiter is evening star, setting about 9:30 P. M. in the middle of the month.

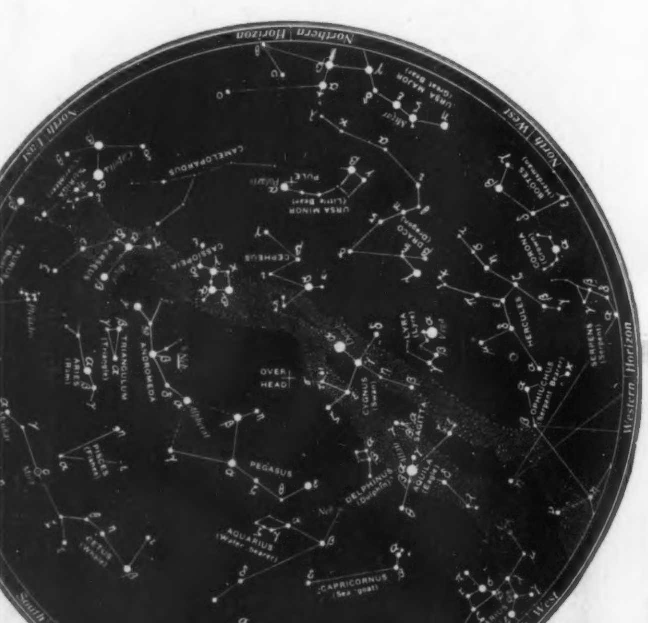
Saturn is in Taurus, and rises about the same time that Jupiter sets.

Uranus is in Capricornus, and comes to the meridian at 8:30 P. M. on the middle of September. Neptune is in Gemini, observable only in the morning hours.

The Moon is in her last quarter at 8 A. M. on the 4th, new at 11 P. M. on the 10th, in her first quarter at 3 A. M. on the 18th, and full at 7 A. M. on the 26th. She is nearest us on the 9th, and farthest away on the 21st.

At 5 A. M. on the 23d the Sun crosses the equator and enters the "sign" of Libra, though not the constellation, since the precession of the equinoxes has carried the two out of agreement since classic times. But in any event, we may say with precision that this is the moment of the autumnal equinox.

Princeton Observatory.



At 11 o'clock: Sept. 6.
At 10½ o'clock: Sept. 14.
At 10 o'clock: Sept. 21.

At 9½ o'clock: September 29.

At 9 o'clock: Oct. 7.
At 8½ o'clock: Oct. 15.
At 8 o'clock: Oct. 22

NIGHT SKY: SEPTEMBER AND OCTOBER

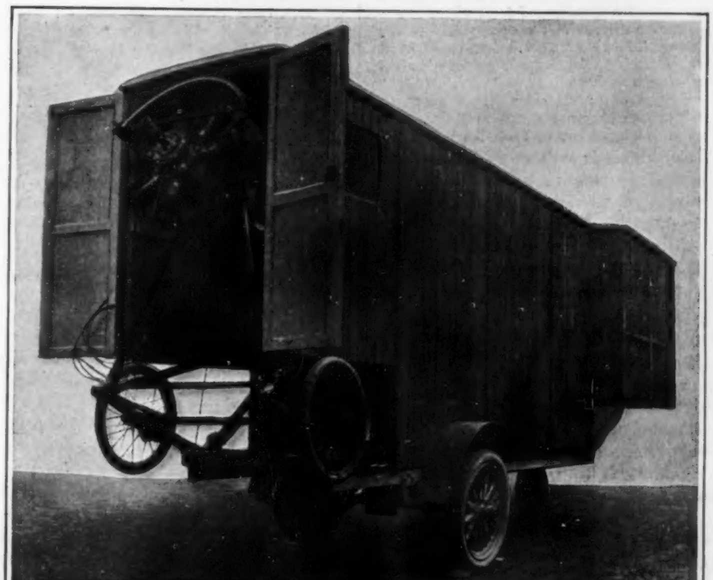
A Swimming Machine

AN inventor living near Paris has constructed an apparatus which for lack of a better name we may call a swimming machine. It consists of a light beam six feet long provided with a float at each end. The swimmer supports himself on this device with his feet on pedals under the rear float. By giving the pedals a reciprocating motion, he operates a propeller that drives the machine through the water. The steering is done by the hands and arms. With a device of this sort the swimmer can make a high speed through the water, because his energies are used to best advantage. The apparatus may readily be folded up and transported. The small insert shows the apparatus in use. The harness on the swimmer's back is connected by a wire to the supports of the rear float and enables the operator to gain a better purchase on the pedals.

Propeller driven swimming machine.

Truck for Aeroplanes.

DURING the recent war maneuvers the aeroplanes of the aviation squad were transported to the aviation station by a motor truck of standard make. The work of this motor truck was very satisfactory, considering the fact that it had to travel over bad roads and very rough ground. The aeroplanes, however, had to be completely dismantled in order to stow them on the motor truck. In European countries trucks of special design have been built for the purpose so that the aeroplanes do not have to be dismantled completely, and hence can be assembled more quickly. The accompanying photograph shows a truck of this type exhibited at the Belgian automobile exposition last winter. This truck is a trailer, not being provided with a driving mechanism, but being adapted to be hauled behind a motor truck or an automobile. The truck is designed to take a monoplane from which the planes have been removed, the latter being packed alongside the body of the aeroplane.



Truck for transporting aeroplanes.

The de Lesseps "Wind Wagon."

By T. M. R. von Kéler.

WHILE the idea of driving motor cars by means of an "aeroplane" propeller is not exactly new, the invention of Counte de Lesseps, shown in the accompanying photograph, presents several exceedingly novel features. It is by all odds the most elaborate attempt on the part of a motor car designer to utilize the pushing power of a large two-bladed propeller. The machine is not an ordinary automobile chassis in which the differential and transmission have been temporarily "declutched," so to say, but it is a car designed especially for this sort of propulsion.

The de Lesseps car has no "live axle," and all its four wheels are "free turning." The propeller is driven by a single chain leading from the main shaft to a short jack shaft to which the blades are fastened. Strong guards made of steel tubing and wire netting form a partial protection for persons approaching the whirling propeller blades. These guards are also expected to catch the broken pieces of the propeller blades in case of an accident. The motor is of 40 horse-power. In its long trial run of over 300 miles the car attained a speed of about 62 miles per hour over fairly good roads—a noticeable feature of the trial being that practically no dust was raised by its passage.

This latter very desirable attribute of such a car is easily explained by the absence of the slanting "dust pan," which hangs below the chassis of the ordinary motor car, and which deflects a strong air current directly upon the road surface. Furthermore, there is the free turning of the rear wheels, which in the de Lesseps car perform only a simple rolling motion, while in the axle-driven automobile the rear wheels exert a strong push or "flip" upon the road surface, causing it to disintegrate.

Difficulties which would tend to overbalance these advantages and to retard a general adoption of propeller drive are not missing. Starting the car in a strong headwind would be almost impossible, the forward pull and speed being largely dependent upon the movement of the surrounding atmosphere; in heavy sand or sticky mud it would also be difficult to obtain sufficient tractive power to overcome suction of the mud at the moment of starting. Once the car has been set in motion it is kept going at a small expense of power.

Then there is the great danger of steering troubles, induced by the constantly changing speed of the car under changing wind conditions, and by the gyroscopic action of the large propeller, which submits the mechanism to enormous torsional stresses. Tests made on the ice here in America with a similar "wind wagon" have shown it to be incapable of taking sharp turns at even moderate speed.

While the de Lesseps car may be interesting from an engineering point of view, there appears little danger of its general introduction—at least in its present form.

The de Lesseps car starting a trip from Paris to Lyons.

Black Lightning Flashes

THE accompanying photograph of lightning, showing both bright and black flashes, was taken at Lake Benton, Minnesota, on the night of May 2d, 1912, at midnight. The shutter was open one minute, during which time probably several successive flashes occurred.

Black flashes are frequently seen in lightning photographs, and the conditions under which they occur are now well understood. White flashes with black borders, as shown in the present case, are a characteristic feature of the phenomenon. The black flash does not occur in nature, but is a trick of the photographic plate, and different kinds of plates are sensitive in very different degrees to the process involved. The present picture was probably taken on a film, and shows the phenomenon in a marked degree.

As long ago as 1889 Mr. A. W. Clayden, the well-known English photographer, showed how to reproduce this phenomenon in the laboratory (*Philosophical Magazine*, 5th series, vol. 28, p. 92-94), whence it has since been known as the "Clayden effect." If an electric spark of moderate intensity is photographed, and the plate is subsequently exposed to a very feeble general illumination (e. g., with gaslight), the plate, after development, will print an ordinary white flash; if the after-illumination is a little brighter, the spark will not appear on the print at all; and, finally, if the after-illumination is still brighter, the spark will print black. In order to get black flashes, therefore, the plate must have been exposed at least twice to the light.

Suppose, now, that a lightning flash has registered its impression on the plate, and before the shutter is closed a second flash occurs in the same field. If the latter is bright enough, the clouds will be lighted up and the light reflected from them will produce the diffuse illumination of the field necessary to produce "reversal" of the original image. That often only the border of a bright flash is reversed is explained by the fact that this is less bright than the "core" of the discharge and is more easily affected by the subsequent illumination of the field.

An attempt to explain the chemistry of this process (somewhat too technical to be given here) will be found in the *Verhandlungen der deutschen Physikalischen Gesellschaft*, September 15th, 1911, p. 676.

In photographing lightning for scientific purposes it is desirable to select plates that are as little as possible susceptible to the Clayden effect; for, as stated above, this effect may entirely obliterate certain flashes. Tests of a large number of plates from well-known makers were made a few years ago by Dr. B. Walter, of Hamburg, to determine which are most satisfactory in this respect. (See *Annalen der Physik*, 4te Folge, Band 27, p. 92.)

An example of "black lightning."

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the eighth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Trade-mark Protection.—VIII.

(Continued from page 165, August 24th, 1912.)

An owner of a valid trade-mark is protected by law in its exclusive use, as he is in the use of any other property that he may own. But to obtain this protection his trade-mark must possess all the essentials of validity, and he must be able to prove infringement, in short, the burden of proof is upon the owner of the trade-mark alleged to have been infringed.

Infringement of a trade-mark is defined in Hesseltine's "Law of Trade-marks and Unfair Trade" as: "An imitation such as would be likely to deceive the ordinary customer in the usual course of trade in the purchase of goods of one person as those of another."

The question of the infringement of a registered trade-mark is covered by sections 16, 17, 18 and 19 of the Act of 1905. Section 16 is quoted here:

Sec. 16. That the registration of a trade-mark under the provisions of this act shall be *prima facie* evidence of ownership. Any person who shall, without the consent of the owner thereof, reproduce, counterfeit, copy, or colorably imitate any such trade-mark and affix the same to merchandise of substantially the same descriptive properties as those set forth in the registration, or to labels, signs, prints, packages, wrappers, or receptacles intended to be used upon or in connection with the sale of merchandise of substantially the same descriptive properties as those set forth in such registration, and shall use, or shall have used, such reproduction, counterfeit, copy or colorable imitation in commerce among the several tribes, or with foreign nation, or with the Indian tribes, shall be liable to an action for damages therefor at the suit of the owner thereof; and whenever in any such action a verdict is rendered for the plaintiff, the court may enter judgment therein for any sum above the amount found by the verdict as the actual damages, according to the circumstances of the case, not exceeding three times the amount of such verdict, together with the costs.

Note that in cases of infringement of a registered trade-mark, suit may be brought in a Federal Court, that triple damages may be collected in case the proof of infringement is established, and the defendant will be forbidden to use the offending mark.

Infringement is a specific violation of the trade-mark statutes. It falls under the broader and more general law of unfair business competition, which takes cognizance not only of trade-mark infringement, but also of all other devices of deception by means of which one person trades upon the reputation of another.

Nims, in his excellent book on "Unfair Business Competition," says:

"The use of a special mark in connection with particular goods or a particular business is a representation that those goods or that business or the goods or business of the person to whom the mark belongs; that they belong to the person to whom the mark has become identified. If such representation is false, a case of unfair competition exists. The law of trade-marks, therefore, is merely a specialized branch of the broader doctrine of unfair competition. Relief in trade-mark cases is afforded upon the express ground that every person is entitled to secure such profits as result from a reputation for superior skill, industry, or enterprise, or, in other words, from his good-will. But, as has just been seen, this is the precise principle upon which relief is afforded in cases of unfair competition. The right of action in technical trade-mark cases is based upon the ground that an exclusive property right in the mark is claimed, and that the mere use of a close imitation of it, by another, *ipso facto* creates a cause for action, regardless of the effect of such use or imitation. But the courts in the past have frequently lost sight of the broad general principles of unfair competition and have sought to decide cases of unfair competition pure and simple 'upon principles analogous to trade-marks.' The owner of a technical trade-mark claims it as his, regardless of the effect on others. If someone else uses it or imitates it, the owner claims a right of action because the mark is his and his alone."

And further on, in the same volume:

"Unfair competition does not necessarily involve the violation of any exclusive right to use a word, mark, or symbol. It may arise from the use of words, marks or symbols which are free for everybody to use and are not subject to exclusive appropriation by any one. The existence of this right of action depends upon the question of fact, whether what was done in any special case tends to pass off the goods of one man as being those of another, or tends to deprive any one of his rights. This is the only substantial distinction between cases of unfair competition, or passing off actions as they are called in England, and cases of infringement of trade-marks."

This subject is so large and far-reaching that we can touch upon it here only in the most general way, and as incidental only to the question of trade-marks.

Unfair competition, so far as trade-marks are concerned, may take various forms, the most common of which are discussed in the following.

Plain Bare-faced Theft of Trade-marks.

In certain lines of business, notably the liquor, wine and cigar trades, this sort of infringement is very common and organizations of houses dealing in these products have been forced to check it. Many States have enacted laws making the counterfeiting of a labor or a trade-mark a penal offense. Under the Federal law, infringement is not a penal offense, and only civil actions may be brought under this statute.

One of the most interesting cases of the adoption of a trade-name belonging to another that has appeared in the Federal courts is that of Wolf Bros. v. Hamilton Brown Shoe Company (165 Federal Rep., 413). Wolf Bros., shoe manufacturers of Cincinnati, had established a common law right to the use of the name "American Girl" as applied to shoes. This mark is not registrable, as it is both geographical and descriptive. The plaintiff has used the mark continuously since 1896. In connection with the wording, there is a lady's head and the phrase: "A shoe as good as its name." Certain styles are designated by numerals, such as 404, 408 and 397. The defendant, a St. Louis company, began to use in 1900 as a trade-mark for shoes, the words "American Lady," with a lady's picture. Later on they advertised "American Lady" shoes with the phrases "With the character of the woman" and "The shoe deserves its name." The numbers used by the complainant in designating styles were also taken by the defendant. The defendant, one of the largest shoe manufacturers in the country, advertised the "American Lady" shoe extensively, spending more than one hundred thousand dollars in publicity after suit had been brought by the complainant. On trial of the complainant's suit for damages, brought before the U. S. Circuit Court, the defendant's treasurer testified that objection to use of the name had been formally made by the complainant in 1901, but that he had considered a protest from a source so insignificant as something of a joke, and had paid no attention to it. The only difference is the use of "Lady" in the defendant's mark instead of "Girl;" the two being in all other respects essentially the same. Judgment was awarded the complainant. The defendant was forbidden to use the "American Lady" mark, and was ordered to turn over to the complainant all profits since the suit begun.

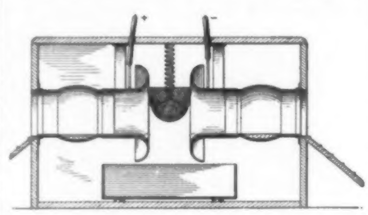
(To be continued.)

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

ELECTRIC RAT EXTERMINATOR.—J. W. M. CARMICHAEL, 331 Commerce St., Wellsburg, W. Va. This exterminator is simple and cheap of construction, and one, which, by means of an electric circuit arranged to be automatically closed by the animal as it passes into and through the apparatus, will

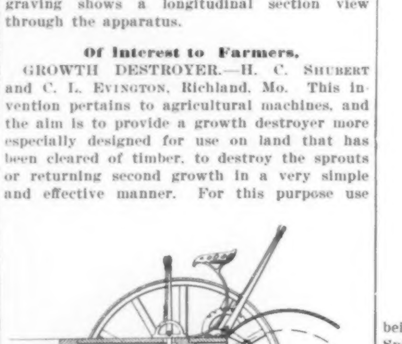


ELECTRIC RAT EXTERMINATOR.

kill the rat. A further object is to construct the apparatus so that the rat as it is killed will fall from the entering passage, and in which the circuit will be automatically opened preparatory to another operation. The engraving shows a longitudinal section view through the apparatus.

Of Interest to Farmers.

GROWTH DESTROYER.—H. C. SHUBERT and C. L. EVINGTON, Richland, Mo. This invention pertains to agricultural machines, and the aim is to provide a growth destroyer more especially designed for use on land that has been cleared of timber, to destroy the sprouts or returning second growth in a very simple and effective manner. For this purpose use



SPROUTS OR GROWTH DESTROYER.

is made of a wheeled vehicle adapted to be moved over the ground and provided with a revoluble beater having flexible arms adapted to forcibly strike and cut off the growth at or near the ground surface. The illustration shows a sectional side elevation of the apparatus.

Of General Interest.

COMBINED DOOR AND SHOW CASE.—A. L. JOHNSON, St. Petersburg, Fla. This invention comprises a show case attachment for a store door, to enable the door to be used for exhibiting samples of merchant's stock, thus saving the space usually devoted to show cases when placed upon counters of the store, and increasing the amount of available space which is used for show purposes in the win-

COMBINED DOOR AND SHOW CASE.

dows. By using glass in the construction, the articles on exhibition can be viewed through either the front or back and articles on the lower shelves can be seen through the upper ones on account of the transparent nature of the material of the shelves. The engraving shows a rear elevation of a store door, with a show case in place thereon.

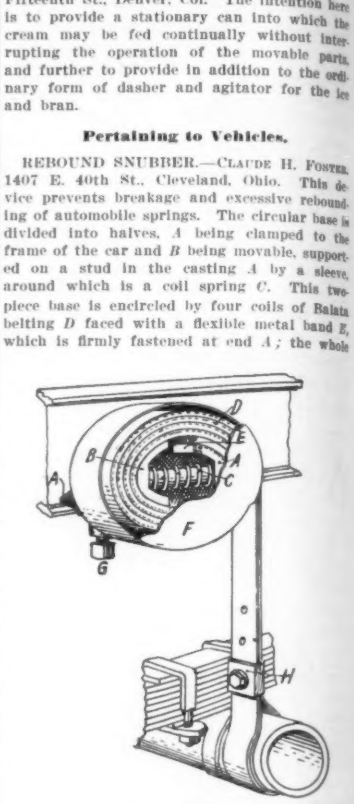
Hardware and Tools.

LINE HOLDER.—G. M. VROOME, 112 Fairview Ave., W. New Brighton, S. I., New York. This holder is for use in shingling roofs, and at other localities where it is desired to mark off a series of parallel lines. A series of lines may be marked off across a surface by operating on one side only of the surface. It may be operated from a distance, and the marking line changed from one location to another without making trips across the marked surface in order to regulate or actuate the device.

ICE CREAM FREEZER.—H. JURGENS, 420 Fifteenth St., Denver, Col. The intention here is to provide a stationary can into which the cream may be fed continually without interrupting the operation of the movable parts, and further to provide in addition to the ordinary form of dasher and agitator for the ice and bran.

Pertaining to Vehicles.

REBOUND SNUBBER.—CLAUDE H. FOSTER, 1407 E. 40th St., Cleveland, Ohio. This device prevents breakage and excessive rebounding of automobile springs. The circular base is divided into halves, *A* being clamped to the frame of the car and *B* being movable, supported on a stud in the casting *A* by a sleeve, around which is a coil spring *C*. This two-piece base is encircled by four coils of Balata belting *D* faced with a flexible metal band *E*, which is firmly fastened at end *A*; the whole



REBOUND SNUBBER.

being inclosed in a dust-proof steel case. Springs move downward uninterruptedly, but excessive upward movement is retarded by friction and the car is kept from excessive swinging up and down. The device shown herewith is now in general use.

FOUR WHEEL DRIVE.—F. P. BERGMAN and H. CLARKE, Cherokee, Okla., care of S. R. Roth, Cherokee, Okla. This invention is an improvement in four wheel drive mechanism, and has for its object the provision of a simple mechanism by means of which power may be applied directly to each of the wheels of a vehicle, without interfering with the turning of the vehicle.

TRACTION WHEEL.—J. BEARD, Veterans Home, Laytonville, Cal. This invention refers to wheels for use with road locomotives, traction engines, agricultural implements, etc., and more particularly to a wheel of the above class, which comprises a revoluble rim having radially movable feet, a series of freely movable guide rollers adapted to be engaged by the feet, and arranged to permit a plurality of the feet to come into contact simultaneously with the ground.

SPRING WHEEL.—G. DORFFEL, 2316 E. 27th St., Fruitvale, Oakland, Cal. This wheel employs two elements, one movable relatively to the other, and one of these elements comprising a hub and a bearing ring rigid relatively to each other and spaced concentrically apart; the other comprising two annular members concentric to each other and also spaced apart and acting as a unit, and spring connections of various kinds from one of these elements to the other.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9267. Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9272. Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities. Large order.

Inquiry No. 9273. Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274. Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted a machi e for packing dry batteries.

Inquiry No. 9278. Wanted a machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No. 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Curious Megalithic Monuments of France

(*Concluded from page 180.*)

The dolmens and roofed alleys of France appear in two forms; either entirely uncovered, or covered partly or wholly by mounds composed of stones, of earth, or of alternate layers of each. Sometimes the base of the mound is surrounded by a circle of stones to keep the mass of earth in place. The orientation of these monuments is very variable. The entrance may be directed toward any point of the horizon, although according to M. Cartailhac it faces the east in the majority of southern dolmens. A flat stone, sometimes provided with a circular, oval or rectangular appature, served as a door and protected the tomb from violation.

To these prehistoric monuments are attached legends and superstitions which are reflected in the popular names of the monuments, Fairies's Rock, Devil's Stone, Giant's Tomb, etc. The Celts and Gauls, impressed by the huge size of the dolmens and menhirs erected by their predecessors, ascribed their construction to gods and heroes, and at a subsequent period the Gallo-Romans saw in them the intervention of Saints. In Gargantua's Tooth, Gargantua's Quoit, Saint Martin's Stone, and others, may be found remnants of the old worship of rocks, of which traces are preserved in all Pagan religions. Even Christianity failed to eradicate these beliefs, to which the rural population of Gaul long remained faithful.

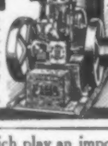
These megalithic monuments must not be confounded with natural stone monuments, especially the rocking stones, which can be set into oscillation by a touch of the finger. Fig. 2 shows one of these stones, which is situated near Boussac. Contrary to old-time opinion, these rocking stones are simply freaks of nature, involving no human intervention.

A menhir is a crude monolithic pillar, a straight row of menhirs is called a colonnade and a ring of menhirs is called a cromlech. According to M. A. de Mortillet the whole number of French menhirs, including those of the colonnades and cromlechs, is 6,192. The distribution of the menhirs does not correspond to that of the dolmens. Both aboun l in Brittany, but few menhirs are found in the southern departments which are rich in dolmens.

The menhir of Locmariaquer (Morbihan), which attains the height of 67 feet, is the most remarkable of all. Unfortunately this colossal needle of granite was overthrown, probably by a stroke of lightning, and broken into five pieces, four of which are now lying on the ground. The original weight of the menhir is estimated by some writers at 250 tons, by others at 347 tons. At all events, this was the highest menhir in France. The second in rank, that of Plésidy (Côtes-du-Nord) is only about 37 feet high. A menhir of about 36 feet stands at Plouarzel (Finistère) and one of 34 feet at Louargat (Côtes-du-Nord). The remaining menhirs of Brittany range from 16 to 30 feet in height. Those of Lampary (Fig. 4) and Chênat (Fig. 1), represent the average dimensions. The menhirs of southern and central France are much smaller. That of Davayat, the tallest in Auvergne, is only about 15 feet high.

The purpose for which these monuments were erected is still a mystery. Some archæologists regard them as primitive idols, others as monuments erected in commemoration of great historical events. It is quite possible that different menhirs were erected for very different purposes. The gigantic needle of Locmariaquer and the little menhir of six or ten feet in height have little in common with each other. Some of the menhirs may be simple boundary marks, which have no religious significance.

The large menhirs, however, are probably religious monuments. The strange practices which have grown up around them in the course of ages, and which still prevail in some districts, are survivals of ancient religious rites. After



the introduction of Christianity into Gaul, the missionaries, not daring to overthrow these ancient sacred stones, surmounted or marked some of them with crosses.

The most celebrated colonnades are those of Carnac (Morbihan), which extend a length of 19 miles from east to west. They are distributed in three groups, separated by vacant spaces, and designated by the names of the villages of Ménec Kermarie and Kerlescan. The Ménec group comprises 1,169 menhirs, arranged in eleven colonnades and one circle or cromlech. The Kemarie group contains 982 menhirs arranged in ten rows, and the Kerlescan group contains 579 menhirs, of which 39 form a cromlech and the rest are arranged in 13 rows. North of Carnac are extensive colonnades, consisting of 1,129 menhirs arranged in 10 lines and covering an area of 6,900 by 210 feet. The colonnades of Plouharnel, Peumarch, etc., are much smaller.

In other places cromlechs are found isolated and not connected with colonnades and avenues. The most typical monuments of this category are the twin cromlechs of Er-Lanic (Morbihan). The two cromlechs are tangent to each other, and one is now partly covered by the sea, even at low tide. The diameter of the imperfect circles varies from 180 to 197 feet. The numerous polished stone hatchets, pieces of crude pottery, granite millstones and primitive tools found in this vicinity indicate that these cromlechs served some other purpose than the retention of funeral mounds. Many hypotheses have been formed in regard to the purpose of the colonnades and cromlechs. Are they temples of the sun, places of sacrifice, or commemorative monuments? The study of their architecture and of the traditions attached to them will possibly solve the problem some day, but at present serious archæologists are content to classify and compare these remarkable prehistoric ruins, without indulging in fantastic conjectures.

Smoke, the Destroyer

(Concluded from page 181.)

draperies and paper are soiled much more quickly in a smoky city than elsewhere. If light paper is used in covering the walls, it must be cleaned every six months and new paper put on every year to keep it looking only half as well as one would wish.

The acid in the soot attacks draperies, rendering them useless in a short time. The extra wear of cleaning materially shortens the life. On interior painting the effect is not as marked because cleaning is done about every so often anyway. But the problem of interior decoration and keeping the outside of a building clean is a problem, indeed, and next to an impossibility in some smoky places. The statement has been made to me by a number of painters that they have done jobs which looked really as bad after two or three days as they did before they were painted. Soot certainly destroys the æsthetic value of paint very quickly. The time which it takes to accomplish the pollution is, of course, dependent upon the amount of soot in the air, the color of the paint, the tar in the soot, etc. The number of paintings required to keep the same building as presentable as in a smoke free city will naturally vary greatly. Cases can be cited where it is necessary to paint three or four times as often as would be required for protection. In the majority of cases in smoky cities the amount of painting is probably doubled. Sometimes it is necessary to remove the soot and the tar and to wash the building before applying the next coat of paint. This washing also removes the paint, often making necessary two coats in place of one for a proper covering. After the wood has received ten to twelve coats it is customary to burn off the paint. This is an additional expense and likewise endangers the house by fire. The action of soot on the wearing qualities of the paint also depends on many factors involving the chemical composition of the paint and the soot. The soot may be acid, neutral or even slightly alkaline. Places are known where the soot in reality acts as a protective coating, and this is probably the case for the most part. Others claim that it is corrosive to the paint surface, destroying the gloss and rendering it much more easily weathered. This is probably true in those cases where the coal burned contains a lot of sulphur and the soot is consequently very strongly acid.

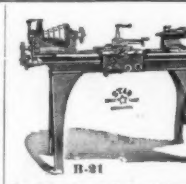
Feeding the Body With Electricity

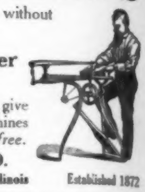
At the Science Advancement Congress, held at Bordeaux, Prof. Bergonié brought out the somewhat startling fact that the electric current can serve to some extent in the place of nourishment for the human body. Should this idea be carried to its fullest limits it may be possible to dispense with taking food and simply remain for a few minutes in a high-frequency electric cage so as to have the body saturated with what might be called electrical nourishment, or in more accurate language the electric currents act to restore energy to the human body in a manner which is analogous to the effect of food. When high frequency currents first began to be used, as Prof. Bergonié says, it was shown by D'Arsonval that these could set up very striking heat effects in the organism, so that the human body is internally heated. Owing to their harmless action, no other effect than development of heat is produced. The liver, heart or brain can receive the high-frequency currents without any bad effect upon their working. Thus the current can supply as large an amount of energy as is desired to the human body, provided the heat is not brought too high so as to cause death of the protoplasm as occurs in Dr. Doyen's electro-coagulation method. But it is not hard to keep within the proper limits, and no danger need occur. With some organisms which are weakened on account of their being deprived of nourishment for any cause, the general temperature may become lowered even by two degrees. A person can thus lose a quantity of heat which is represented by one twelfth of the daily ration of that organism. It is, therefore, a wonderful result to make up for this deficit without calling upon the digestive organs and without increasing one's daily ration, also without introducing any drugs into the blood or tissues. Electricity allows of sending a quantity of energy which may be considerable into the living organism under the form of high-frequency and low-tension currents, and this action can be repeated as often as is needed. He finds that in experiments made at the Bordeaux college, overworked or enfeebled persons, anemics and the like, showed that the current caused a toning up of the system and abolished stomach overwork. Force reappeared and he found a considerable gain in weight. Commenting on this, he remarks that we once thought that chemistry would solve the problem of food, and that we could be nourished by chemical products. But this does not appear to be realized even in this age of progress. Perhaps electricity will now be able to come in where chemistry failed, and in the future ages we will be electrically fed.

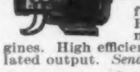
Military Aviation Abroad

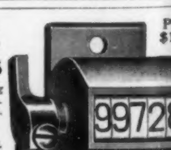
By the Paris Correspondent of the Scientific American

A Berlin correspondent of the Paris daily journals states that Prince Henry of Prussia is engaged upon an aerial mitrailleuse which is being worked with in secret, but some of the details are known at present. The mitrailleuse is mounted upon an aeroplane so that it can be aimed directly by the movement of the latter, being placed in front of the pilot's seat upon the framework. It is thus aimed by raising or lowering the aeroplane as a whole by using the rudder, and a side displacement is secured in a like manner. A single pilot thus serves for flying as well as firing, and the recoil takes place always according to the direction of flight so that there is no danger of capsizing. It appears that this is the









result of a programme which the German army has been engaged in following for some months past. Armored aeroplanes are being built and great attention is given to this point, although but little information has transpired. It appears that the army recognizes that the number of its pilots is much less than in France or Russia, and to counterbalance the inferiority in the number of aeroplanes which can be put out, if this statement is to be believed, the army intends to make this up by quality if not by quantity. Eight of the most experienced pilots are selected, and they will have special aeroplanes which act as destroyers and not for scouting purposes like the enemy's flyers. The destroyers will be very rapid and will carry mitrailleuses and other arms with ammunition. In order to make a quick flight they will be fitted with powerful motors of 130 or 140 horse-power, and to avoid shot which might carry as far as 1,500 feet as experiments showed, they will have armor plated parts especially around the pilots, motor, tanks, and steering gear. The armor is heavy enough to stand shot fired as close as 600 feet. According to the programme, the enemy's aeroplanes commence to reconnoiter the front of the German lines. Thereupon the armored aeroplane takes its flight, and as it makes a higher speed of 70 or 80 miles an hour, while the enemy makes only 50 miles an hour, it reaches him after a short pursuit and seeks to destroy the aeroplane. When this is done it comes back to headquarters and is ready to begin another attack.

Admitting that the information about the armored aeroplane is correct, there may be made some exceptions to the above statements. On one hand, it is claimed that the German army will be able to put out as many aeroplanes as the French, and should this be true, the addition of the "destroyers" will give them an advantage, at least for the time. However, it is stated that ordinary aeroplanes will be able to make as high a speed as the destroyers, so that they will be out of danger. The Russian army, in fact, ordered about 100 aeroplanes from the Paris Nieuport establishment about the first of the year, these being of the two-place type, and will be used for scouting purposes. They are to make a speed of 75 miles an hour, so that even should the German aeroplanes have a slightly greater speed, they will not reach the enemy before he is ready to alight in a safe place. Again, the Russian army is also engaged in building aeroplane destroyers of a similar kind, and have already ordered a number of these from a French construction firm.

Salving the Steamer "Jose"

(Concluded from page 178.)

under the "Jose" was a long, tedious and difficult one, that of raising the vessel after the chains had been passed under it was far more delicate and required a great deal of skill based on long experience in such work. The tension on the chains had to be regulated to a nicety so that each would bear its own share of the burden, and here is where the practice of years in wrecking showed itself. No instruments were employed for testing the tension on the chains. Practical judgment and experience alone were used. To raise the wreck the pontoons were filled with water, sinking them as far as practicable, and at low tide the slack of the chains was taken in and their tension adjusted. Then as the tide rose the pontoons were pumped dry, and with the combined lift of the pontoons and the tide, the vessel was raised out of the pocket in which it had lain and was towed off. When it grounded the wreck was allowed to rest on the bottom at high tide, and at low tide the pontoons were filled again, the slack in the chains was taken up and then with the rising of the tide the pontoons were pumped dry and the vessel was lifted enough to carry it farther. This process was repeated until the decks were clear when the divers entered the vessel, and closed all the ports. Then the ship was pumped clear of water and floated.